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Vol. XXI] SEPTEMBER 1952 [No. 9

	Page
Popularisation of Science	235
Planning of Scientific Research in Relation to National Reconstruction	236
Prof. G. I. Finch	236
Petrogeometric Interpretation of a Crushed Conglomerate from Rangamatia, Singhbhum District, Bihar—Prithwish Kar and Uday Narayan Sarkar	237
Letters to the Editor	239
Need for Geophysical Research in India—Dr. J. C. Ghosh	257
Reviews	258
Science Notes and News	263

POPULARISATION OF SCIENCE

IN the words of Prof. de Broglie, the dissemination of scientific knowledge among non-specialists has to-day become a very important and delicate problem; very important because it is essential that public opinion at all levels should be able to understand the scope of scientific progress, its intellectual value and the tremendous repurcussions which it can have on the future of our civilisation, and very delicate because scientific knowledge is each day becoming more extensive and more complex so that it is very difficult to make its meaning comprehensible to the general public without an unfortunate distortion of some of its aspects.

It may no doubt be that the delicacy of the problem arises because of its importance, but judging from the standards of perfection achieved in this direction so far by such great names in the field of science as Faraday, Sir James Jeans, Bertrand Russell, J. B. S. Haldane, Louis de Broglie, and Sir C. V. Raman in our own country, the situation may indeed be regarded as hopeful rather than otherwise.

In this connection it may perhaps be necessary to point out the bearing which the popularisation of science has on the growth of science itself. The domains of any one branch of science such as spectroscopy have been rendered so vast by the great and rapid strides of progress that a specialist in it finds himself after some years unable to follow the developments in some such other branch as biochemistry. This is indeed to be considered as very unfortunate since a progressive intermingling—cross-fertilisation as it were—of the various disciplines is becoming more and more a condition necessary for growth and progress.

Reduced to its fundamentals, popularisation of science is a matter of choosing the words known to the common man but using them in a special sense so as to take him over to the domain of knowledge he is a stranger to. This is in sharp contrast to the way usual with specialists of inventing a new word rather than extending the use of the known one. This tendency is quite understandable because the specialist has other business than being the full-fledged literary scientist such as popularisation of science might demand. There is no doubt that the use of specific technical terms with a precise significance attached to each of them has its own advantages; but it will be a wonder if it should not create difficulties, especially when it becomes unmanageably large as at present and when the same term might have entirely different meaning in different branches of science. This is where we believe popularisation of science has a most significant part to play, *viz.*, to enable the specialist to keep down the number of technical terms to the indispensable minimum and to evolve a vocabulary common to a number of allied branches. If we may hazard a guess, the greater the importance assigned to popularisation of science,

the greater will be the chances for the progressive intermingling of the various branches and for the cropping of such disciplines as cybernetics and biophysics.

There have, of course, been historical reasons why popularisation of science has not yet come into its own in our country, but it is to be hoped that the matter will receive more serious attention from all quarters in the future. It is a welcome sign that the Kalinga Prize for the popularisation of science should have been instituted by an Indian; even more welcome is the formation of an Association of Scientific Writers in India for the same purpose. But we feel that the active co-operation of our industrialists, the press and the Government of India will be needed for the establishment of Journals of the type of *Scientific American*, not only in English but in almost every regional language. The part to be played by our leaders of science in the various branches is also considerable: they may not rest on their laurels unless they make it an integral part of their scientific programme to enable the common man to take an intelligent interest about what they are after.

PLANNING OF SCIENTIFIC RESEARCH IN RELATION TO NATIONAL RECONSTRUCTION

IN the course of his Acharya Profulla Chandra Ray Memorial Lecture, Dr. K. G. Naik, Rector of the Gujrat University, observed:

The U.S.S.R. has surpassed all other countries in the co-ordination of scientific research, by organizing three kinds of institutes, namely, (i) The Main Institute undertaking industrial as well as pure fundamental research work, in connection with the problems passed on to them by (ii) The Branch Institutes which, in their turn, test, on a semi-manufacturing scale, the results of research arrived at by the Main Institutes and then only they pass them on to (iii) The Subsidiary Institutes which are the ones directly in touch with agricultural farms, factories, mills, etc.

Here is something which India should pause to study and translate into practice. No research worker should be allowed to do what he likes, when India is facing a plethora of problems in industry, agriculture, health, social psychology, social economies, etc. The country should plan out schemes for research, as based on its socio-economic needs. To work out the solutions of problems immediately facing the country, all the scientific research institutions as well as trained scientific man-power must be well organised all over the country, with a view to putting into practice what has already been discussed, or improving old methods or replacing them by new ones.

According to one of the members of the Cultural Mission which recently returned from China, most of the scientific and technical institutes in China are concentrating on practical applied work of immediate urgency and interest. There appears to be some liaison agency between the Government and the institutes whose job it is to sift out immediate practical problems for research and pass these on for investigation by the institutes. The advanatges of a similar co-ordinating agency in India, linked perhaps to the Planning Commission, can hardly be exaggerated.

PROF. G. I. FINCH

PROF. G. I. FINCH, F.R.S., has been appointed by the Council of Scientific and Industrial Research, India, as Director of the National Chemical Laboratory of India, Poona, in succession to Prof. J. W. McBain, F.R.S., who has just retired.

Prof. Finch has had a long and distinguished academic career and his researches have ranged over many fields. Under the late Prof. Bone's influence he first turned towards the efficient use of coal and its by-products, safety in mines and catalytic combustion, and these interests were reflected in his early researches on the ignition and combustion of gases. His recognition of the vital role played by surface structure in heterogeneous catalysis led him to the study of surfaces by electron diffraction, a technique with which his name is internationally associated, and which he has applied to the examination of a wide range of chemical and physical problems. This work was recognised by his election to the Francqui Chair in the University of Brussels in 1937-38 and, in conjunction with his important fundamental work on the electrical ignition of gases, by the award of the Hughes Medal of the Royal Society in 1944.

As Director of the NCL, Professor Finch will find ample opportunity to pursue his many interests in the field of applied chemistry to the advantage of Indian economy.

PETROGEOMETRIC INTERPRETATION OF A CRUSHED CONGLOMERATE FROM RANGAMATIA, SINGHBHUM DISTRICT, BIHAR

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CLOSE to the village Rangamatia (22° 45′ 30″: 86° 02′; 73J/1) and for some considerable distance strikewise to the east and west of the village, an impersistent band of quartzite runs parallel to the main thrust zone of Dunn and Dey.[1,1a] At Rangamatia the strike is NW-SE, which changes to a nearly E-W direction westwards of Rangamatia. Dips are northerly. Lying close to the thrust zone, about 3 to 4 furlongs to its north, the band is made up of a number of small, detached exposures—as many as 18 of these being noted around Rangamatia. The majority of the exposures lie within chlorite-talc-schists and a few within a tongue of schistose soda-granites. Amongst the associated rock types, the closest to the quartzites in affinity are chlorite-mica-schists.

To the east and south-east of Rangamatia, three of the exposures are seen to consist of ellipsoidal pebbles of quartz cemented together in a matrix of quartz, magnetite, hydrous iron-ores, sericite and biotite. The long axes of the pebbles exhibit a certain degree of preferred orientation. The trend and inclination from the horizontal of 100 long axes of the pebbles selected at random were measured. The long axes were determined by actually measuring all the three axes of each selected pebble. It was observed that the dominant trend of the

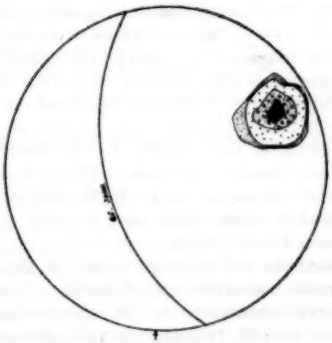

FIG. 1. Axes of lineation–100 ellipsoidal pebbles
Contours:- 0·5-2·5-25-60%
(Maximum concentration 86 % per 1 % Area)

long axes was 60°, with a maximum deviation of 5°. All the axes were further found to be inclined towards 60°, the amount of inclination varying from 15° to 38°. The axes were plotted on an equal area net, the diagram (Fig. 1) indicating a very well-developed point maxima. This marked lineation of the long axes was, therefore, chosen as the *b*-axis of the megascopic fabric. The flattened surfaces of the pebbles were found to lie statistically parallel to the *ab*-plane.

Quartz-axes diagrams, both selective and non-selective, were prepared from sections cut parallel to the *ac*-plane in different specimens. The texture of both pebbles and matrix was cataclastic. A non-selective quartz-axes diagram of 100 grains indicated a minor concentration around *b*, and a sharply separated, well-developed *ac*-girdle (Fig. 2). The lineation when

FIG. 2. (Non-selective) 100 Quartz grains
Contours:- 0·5-1·5-3·5-5·0%
(Maximum concentration 7 % per 1 % Area)
Specimen No. A/29

interposed on the diagram, very nearly coincided with the axis of rotation of the girdle (*b*), proving that the choice of the fabric axis was correct. Selective quartz-axes diagrams of 50 grains out of a pebble (Fig. 3) and of 100 grains from the matrix (Fig. 4) also exhibited similarly patterned diagrams.

Comparison of Figs. 2, 3 and 4 revealed that the concentration around *b* was much less pronounced (about only 1·5% per 1% area) in Fig. 2 (Specimen A/29) than in Figs. 3 & 4 (Specimen OR/9—about 5·5% and 17% per 1% area respectively). The pebbles were less in number and of much smaller dimensions in Specimen A/29 than in OR/9. Another non-selective quartz-axes diagram (Fig. 5) of 150

grains prepared from Specimen OR/11 revealed a total absence of concentration around *b*. There were well-marked maxima about *a* instead. In Specimen OR/11, there were no pebbles at all but a strongly developed lineation.

FIG. 3. (Selective) 50 Quartz grains of a pebble only Contours:-0·5-1·5-3·5-5·5-7·5% (Maximum concentration 10% per 1% Area) Specimen No. OR/9

Diagrams 2-4 suggested that the resultant fabric of the conglomerate was produced by the simultaneous rolling of the pebbles together

FIG. 4. (Selective) 100 Quartz grains from the matrix only Contours:-0·5-1·5-3·5-5·5-7·5-10·5% (Maximum concentation 17% per 1% Area) Specimen No. OR/9

with the matrix parallel to the *b*-axis, giving rise to the peripheral *ac*-girdle. Such rolling might have been brought about by interplanar slips parallel to the *ab*-plane, thereby flattening the pebbles parallel to *ab*. The rolling might presumably have caused further, a concomitant elongation parallel to *b*. The retention of the fine-grained cataclastic texture by the conglomerate would point to the absence of any *para*- or post-tectonic recrystallisation. The maxima around *a* in Fig. 5 in place of the usual maxima around *b*, implied that in the presence of the pebbles, the rolling of the parent rock parallel to *b* not only produced a prominently developed *ac*-girdle, but the '*c*' axes of the ruptured grains drawn out during the elongation of the pebbles parallel to *b* concomitant with such rolling, were concentrated around *b* as well. When no pebbles

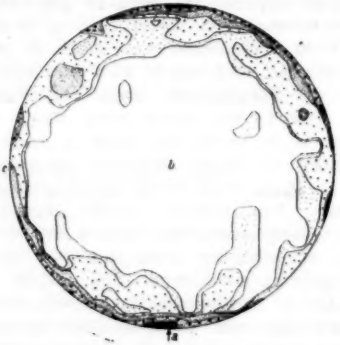

FIG. 5. (Non-Selective) 150 Quartz grains Contours:-0·5-1.0-3·0-6·5-13% (Maximum concentration 18% per 1 % Area) Specimen No. OR/11.

were, however, present to exercise such a control, the grains ruptured during the deformation were naturally concentrated around *a*, due to forward rolling, thus producing Maxima 1. In other words, the pebbles are *not* the products of cataclastation of the parent rock; but were present originally as a textural variant in the arenaceous parent material. It is worthwhile to note here that Specimen OR/11 was obtained from an exposure only about 450 ft. away (dipwards) from the exposure which yielded Specimen OR/9.

The trace of a well-developed set of joints, dipping 60° towards 288° was plotted on Fig. 1. These joints, at right angles to the lineation are typical *ac* tension fractures. There is another feebler set trending nearly E-W (106°). Milky-white quartz veins were seen to infill and also cut across these joints.

The authors are indebted to Sri. S. Sen of the Department of Geology, Calcutta University, for helpful guidance in the interpretation of the data, and to the Director, Geological Survey of India, and the Director, Indian Bureau of Mines, for permission to publish the paper.

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LETTERS TO THE EDITOR

	Page
Raman Spectrum of Carborundum—P. S. Narayanan	239
Spectral Studies of Oxoniser Discharges in Nitrogen—R. K. Asundi and N. Appalanarasimham	240
Refractivity of Organic Vapours—S. Venkataraman	241
Granular Structure in Rock Sections and Transmission of Sound—S. Balakrishna	241
Origin of the Alkaline Rocks of Kishangarh, Rajasthan—Saurindranath Sen	242
Piedmontite from the Champion Gneiss Near Robertsonpet, Kolar (Mysore State)—M. G. C. Naidu	243
Isomerisation of the Dark Green Chromic Chloride Hexahydrate in Acetone, a Zero Order Reaction—V. S. Subrahmanyam and D. S. Datar	244
The Use of Ammonium Molybdate as Catalyst in the Estimation of Dichromate—D. V. Ramana Rao	244
Electrochemical Properties of Hydrogen Clays from Contiguous Black and Red Soils from Bhopal—S. C. Das, Ambadas Rao and R. V. Tamhane	245
The Fries Rearrangement of Isomeric Acetoxy-Resorcyclic Acids and Their Esters—N. M. Shah and G. C. Amin	246
Anti-Tubercular Activity of Sesamin—P. R. J. Gangadharam, N. L. Narayanamurthy and B. H. Iyer	246
A New Class of Free Radicals—R. H. Sahasrabudhey and (Miss) Indumati Bokil	247
Some Guanido-Arsenicals as Possible Anti-Malarials—J. R. Guha, S. S. Guha, A. C. Roy and P. C. Guha	247
Chlorophyll Deficiency in Striga—K. Meenakshi and P. Krishna Rao	248
Pharmacological Study on a Group of 4-Piperidone Derivatives for Their Spasmolytic Properties—V. Iswariah and V. S. Venkata Subbu	248
Solanum jasminoides *Virus*—Pushkarnath	249
Vernalisation of Cabbage Seeds (Brassica oleracea *var.* capitata)—N. N. Dikshit and U. P. Singh	249
Occurrence of a New Race (*No.* 122) *of* Puccinia graminis tritici *in Bombay State*—V. P. Gokhale and B. P. Patil	250
Amino Acid Make-Up of Vegetable Milk—D. K. Nandi and R. Rajagopalan	250
The Occurrence of a Blood-Anticoagulant Factor in the Latex of Carica papaya—T. Ramakrishnan, N. C. Pillai and K. V. Giri	251
Preservation of Paper Chromatograms—K. Krishnamurthy, T. A. Venkatasubramanyan and K. V. Giri	252
The Embryology of Borreria hispida *K. Schum,* (= Spermacoce hispida *Linn.*) (*Rubiaceæ*), *A Reinvestigation*—Mohd. Farooq	252
Occurrence of Transaminase in the Silkworm, Bombyx mori *L.*—B. Bheemeswar and M. Sreenivasaya	253
Isolation of a New Saponin and Sapogenin, Albizziagenin, from Albizzia lebbek, *Benth.* (N. O. *Leguminosæ*)—I. P. Varshney and M. O. Farooq	255
Ferriferous Diopside (Salite) from Gotivada, Vizagapatam District—S. V. Lakshmi Narayana Rao	256
4-Hydroxy 2 : 5 Dimethyl Quinoline and 4-Hydroxy 2-Methyl 5-Chloro Quinoline—B. P. Bangdiwala and C. M. Desai	256
Detection of Molybdenum—Importance of Hydrogen Ion Concentration—D. V. Ramana Rao	257

RAMAN SPECTRUM OF CARBORUNDUM

Carborundum crystals are known to exist in five different forms,[1] four of which belong to the hexagonal class and the remaining one cubic. Because of the simplicity of its structure this substance offers scope for a detailed study of its vibration spectrum. Consequently, a preliminary study of its Raman spectrum was made by the writer nearly a year ago and it has not been possible since then to pursue this study further. For this investigation a thin transparent plate of carborundum was placed at the disposal of the writer by Prof. C. V. Raman to whom the author's grateful thanks are due. Using the λ 4358 radiation of a mercury arc as exciter and a Hilger two-prism spectrograph of high light gathering power, its Raman spectrum was recorded. The spectrogram, though faint, revealed the existence of a fairly sharp Raman line with a frequency shift of 818 cm.$^{-1}$ and a few feebler ones in its neighbourhood. The sharp line may be assigned to the fundamental mode in which the carbon atoms oscillate against the silicon atoms. The frequency shift of this line is found to correspond with the strong infra-red reflection maximum at 12 μ reported by Schæfer and Thomas[2] in one of the hexagonal forms of carborundum. An examination of the optical properties of the specimen used by the writer showed that it is also of the hexagonal class. From the known symmetry of carborundum, this coincidence between the infra-red maximum and the Raman line is only to be expected, even if the form of the specimen used

by the author is different from that employed by Schæfer and Thomas.

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1. Ott, H. *Zeits f. Krist*, 1925, **61**, 515; **62**, 201; 1926, **63**, 1. 2. Schæfer and Thomas, *Zeits. f. Phy.*, 1923, **12**, 230.

SPECTRAL STUDIES OF OZONISER DISCHARGES IN NITROGEN

THE spectrum of an ozoniser discharge at voltages from 800 to 6,000 in pure stagnant nitrogen at 20 mm. pressure is characterised by the presence of a large number of band systems of the nitrogen molecule. Extended exposures of over 60 hours do not record, even as traces, any one of the NO bands. The following Table contains a complete list of band systems and bands and lines obtained in these experiments. The intensities are visually estimated relative values. In the case of band systems, they represent the intensity of the strongest band of the system recorded.

Bands	r_e in the initial state (*cf.* Rosen and Herman)	Intensity
Triplet systems :		
2nd positive ..	1·2123	100
4th do ..	1·108 (r_0)	30
1st do ..	1·293	0·5
Singlet systems :		
P system ..	1·12 (r_0)	40
Q do ..	1·32$_8$ (r_0)	20
δ do ..	(1·27)	20
R do ..	1·20 (r_0)	20
S do ..	1·23$_2$ (r_0)	20
T do ..	1·22 (r_0)	20
θ do ..	..	2
2839 and 2980 A ..	..	15
2462·3, 2567·5, 2679·7 and 2810·6 A ..	..	1
2723 and 2852·4 A ..	..	10
Kaplan's 2nd system ..	1·16 (r_0)	15
5th positive or Van der Ziel's	1·18	5
N_2^+ *system*		
1st negative ..	1·075	60

In addition to the above, the following lines and band heads due to trace impurities have been recorded on long exposure plates, with intensities ranging from 10 to 20 on the above scale: 2883 and 2896 A due probably to CO_2^+, 3064 A due to OH, 2536 A due to Hg.

Unclassified bands :

2417·9, 2424·0, 2459·6, 2612·0, 2673·0 and 2907·5 A

r_e in the ground state, $X\,^1\Sigma_g^+$, 1·094

The characteristic features of the spectra are :

(*a*) Among the triplet systems, the second positive is the strongest with the fourth positive as the next best. The first positive system is extremely weak. While an exposure time of 2 hours brings out all the bands of the second positive system on a small quartz Hilger E_2 spectrograph with the usual slit width of 0·02 mm., only a faint impression of three groups of the first positive system at 5850 A, 6200 A and 6600 A, is obtained in 24 hours with a slit width of 0·22 mm., other factors being strictly the same. No other system is recorded.

(*b*) Among the singlet systems involving transitions to $a^1\pi_g$, seven out of the eight known systems (Gaydon and Herman, 1946) are excited simultaneously, whereas some of these systems are known to be selectively excited under special conditions of excitation and discharge (Rosen and Herman, 1951) like the luminescence discharges, discharges in the presence of rare gases and through nitrogen at moderate but controlled pressures and mildly condensed hollow cathode discharges through flowing nitrogen at a few mm. pressure. The single progression of bands at 2839 A and 2980 A, recorded by Janin (1949), is obtained; in addition, there are two more progressions which also probably involve transitions from new initial electronic levels to the $a^1\pi_g$ state.

Among the electronic levels that are excited, there are many in which the internuclear distance is much different from that in the ground state of the molecule. This indicates that under the present conditions of discharge, excitation of spectra is brought about not only by electron collisions but also appreciably by atomic and ionic collisions. This view is further borne out by observations based on microphotometer traces of the first and second positive bands. These show: (1) Among the groups of bands excited in the first positive system, the group at 5850 A ($\Delta v = 4$ sequence) is stronger in intensity than that at 6600 A ($\Delta v = 3$ sequence). The relative intensity distribution is thus similar to the one obtained in the afterglow spectrum (Johnson, 1949) or the positive column discharge through nitrogen (Pearse and Gaydon, 1950) wherein ions and metastable atoms play a significant part in the excitation of spectra. (2) The relative intensity distribution of the (0, 1), (0, 2) and (0, 3) bands of the second positive system resembles more or less the one obtained in the positive column discharge in air (Tawde, 1934).

The abnormally low intensity of the first positive bands in this type of ozoniser discharge is probably due to deactivation of the excited emitters in the electronic level, $B^3\pi_g$, by collisions (Gaydon, 1944; Tawde and Patankar, 1944) and by possible radiationless transfer to repulsive states (Kaplan, 1931; Okubo and Hamada, 1932) in the manner suggested by Zener (1933).

Details are submitted for publication elsewhere.

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June 4, 1952.

1. Gaydon, A. G., *Proc. Phys. Soc.*, 1944, **56**, 85. 2. —, and Herman, R., *Ibid.*, 1946, **58**, 292. 3. Janin, J., *Science Abstracts*, 1949, **52**, 737. 4. Johnson, R. C., *An Introduction to Molecular Spectra* (Methuen & Co.), 1949, p. 44. 5. Kaplan, J., *Phys. Rev.*, 1931, **37**, 1409 6. Okubo, J. and Hamada, H., *Ibid.*, 1932, **42**, 795. 7. Pearse, R. W. B. and Gaydon, A. G., *The Identification of Molecular Spectra* (Chapman & Hall, Ltd.), 1950, p 363 f. 8. Rosen, B, and Herman, R., *Constantes Selectionees Donnees Spectroscopiques Concernant les Molecules Diatomiques* (Hermann & Cie, Depositaires, Paris-Ve), 1951, p. 199 f. 9. Tawde, N. R., *Proc. Phys. Soc.*, 1934, **46**, 324. 10. —, and Patankar, V. S., *Phil. Mag., Ser.* 7, 1944, **35**, 616. 11. Zener, C., *Proc. Roy. Soc.*, **A.**, 1933, **140**, 660.

REFRACTIVITY OF ORGANIC VAPOURS

EMPLOYING the method described in a previous communication,[1] the refractivities[a] of some liquid vapours were determined using the Rayleigh refractometer. The observations were made at the room temperature and the refractivities were reduced to N.T.P. by means of the formula $n_0 - 1 = (n - 1)v$, where v was calculated from Berthelot's equation taking the necessary constants from I.C.T.[2] The results are given in Table I with a probable error less than 0·25%.

TABLE I

No.	Substance	Temp. °C.	Vapour pressure mm.	$(n-1)\times10^6$	$(n_0-1)\times10^6$
1	Benzene ..	27·4	105·2	243·1	1917
2	Carbon tetrachloride	28·8	135·5	296·6	1821
3	Cyclohexane ..	33·4	139·0	318·5	1935
4	Methyl acetate ..	30·7	273·8	397·1	1209
5	Methyl alcohol ..	30·5	162·1	108·6	564

The refractivity of cyclohexane vapour does not appear to have been determined previously. For the rest, the values of $(n_0 - 1)$ given here are generally somewhat higher than the corresponding values given in I.C.T.[3] which are, however, in some cases, given with reserve.

Also the variation of the refractivity of saturated vapours with temperature was studied and compared with what may be expected from theory. Applying the ideal gas laws to the vapour, Gladstone and Dale's Law may be written in the form $(n-1)T/p = \text{constant}$, which on differentiation yields

$$\frac{1}{p}\frac{dp}{dT} = \frac{1}{T} + \frac{1}{n-1}\frac{d(n-1)}{dT},$$

The left hand side was evaluated from vapour pressure data given in I.C.T.,[4] and the right hand side from refractivity measurements. The results are given in Table II. It is seen that there is agreement within 1·7%.

TABLE II

No.	Substance	T (°K)	$(n-1)\times10^6$	$\frac{d(n-1)}{dT}\times10^6$	$\left[\frac{1}{n-1}\frac{d(n-1)}{dT} + \frac{1}{T}\right]\times10^3$	$\frac{1}{p}\frac{dp}{dT}\times10^3$
1	Benzene ..	301·5	253·1	10·52	44·90	45·21
2	Carbon tetrachloride	302·8	308·1	12·30	43·22	42·46
3	Cyclohexane ..	307·8	335·7	12·66	40·98	40·38
4	Methyl acetate ..	305·5	423·1	15·88	40·80	40·96
5	Methyl alcohol ..	304·7	114·8	5·42	50·44	49·63

All the liquids used were Merck's guaranteed reagents except cyclohexane which was obtained from Kodak.

The author is thankful to Prof. M. Ramanadham for his interest in this work.

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[a] For the mean D line.

1. Venkataraman, S., *Curr. Sci.*, 1952, **21**, 156. 2. *International Critical Tables*, 1928, **3**, 248. 3. *Ibid.*, **7**, 10. 4. *Ibid.*, **3**, 215-27.

GRANULAR STRUCTURE IN ROCK SECTIONS AND TRANSMISSION OF SOUND

IN the course of a detailed investigation on the elastic behaviour of rocks by ultrasonic methods,

the author has come across an interesting result connecting the granular structure of a rock section and the transmission of ultrasonic waves through it. Fig. 1 (*a*) represents the ultrasonic

pattern obtained after the sound wave is transmitted into a liquid through a limestone section and Fig. 1 (*b*) is similarly obtained with a granite section. In both cases, the same quartz wedge is the source of ultrasonic waves and the thicknesses and frequencies employed are nearly the same as will be seen from the following data:

	Thickness in m.m.	Frequency m.c./sec.	Velocity m./sec.	Density g./c.c.	C_{11} dynes/cm.^{2}
Lime stone	2·590	2·55	6360	2·841	$11{\cdot}5\times10^{11}$
Granite	2·537	2·76	7148	2·732	$13{\cdot}9\times10^{11}$

Care has been taken to keep the power of the oscillator same in both the cases. The photographs clearly show that high frequency sound is transmitted freely through the limestone but largely absorbed, probably by a process of scattering in granite. Granite in this investigation is of the pink variety occurring in Hyderabad State and its texture is inequigranular, the mineral composition varying from grain to grain. On the other hand, the limestone studied, which is from Piduguralla area, is steel black and the section is equigranular. All the grains in the section possess nearly the same mineral composition. A further distinction has been found in that the transmission maxima are sharp in limestone and comparatively broad in granite. The author has investigated a large number of rock sections and the results in practically all of them show that the differences in granular structure are clearly reflected in the differences of sound transmission as studied by the ultrasonic wedge method.

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June 23, 1952.

ORIGIN OF THE ALKALINE ROCKS OF KISHANGARH, RAJASTHAN

A DETAILED study is here reported of the structural features of an exposure of alkali syenite occurring north-east of Kishangarh, Rajasthan, within the Aravalli metamorphites. These latter consist chiefly of quartzites (biotite and amphibole bearing) with a little amphibolite and calc-granulite.[1] The nepheline syenite appears coarse-grained and is more or less granitoid at the centre of the exposure, the glomeroporphyritic clots of amphibole arranged in linear trends imparting a faint lineation. Outwards, on both sides, a faint foliation is seen to have been developed and at the outermost margin the rock becomes well banded gneissose, more in the nature of a composite gneiss, showing ptygmatic folding and other minor characters that correspond to similar features in the migmatitic granite exposed further east. The dark bands in both these rocks are amphibolites or amphibole-rich assemblages.

The Aravallis have been thrown into a series of folds forming pitching anticlines and synclines arranged *en echelon*. The main mass of the nepheline syenite, besides showing no discordance along its borders, repeats all these structural features faithfully. Even with regard to its lineation it does not exhibit any structural independence. These lead to the conclusion that all the major structural features have been impressed simultaneously in all the rocks of the region, and the structures within the alkaline rocks or outside it are members of the same regional pattern. The granite migmatites are obviously results of post-kinematic granitization and no evidence has yet been obtained which would suggest the existence of a regional polymetamorphism or a second period of diastrophism.

Some local structures, not conforming to the regional alignments, may be ascribed to the volume change accompanying the transformation. Thus, the ptygmatic folds in the granitic migmatites are types of flow structures incidental on the metasomatosis, and similar features in the alkali syenites have to be similarly interpreted. Minor displacements along joints, drawing out or rotation of amphibolitic clots and other such features in the nepheline syenite could be produced similarly. These might have been accentuated by viscous flow if the metasomatosis had taken place through the intervention of liquids.

The above considerations have led the author to propose tentatively an entirely new mode of

origin for the alkali syenites. The imperceptible passage of the granitoid nepheline syenite, through the foliated to the migmatite variety, taken together with the structural concordance, prove that the rock is a metasomite, transformed *in situ*, and that the group is genetically connected with the associated granite migmatite. The suggestion differs from von Eckermann's in ascribing the metasomatosis to the same agent responsible for the regional granitization rather than to a carbonate magma[2] and also as regards the conclusion that the associated granite, instead of giving place to the alkaline rocks, has been derived simultaneously by a similar process. Culmination of regional diastrophism was marked by entrance of emanations, and in cases where the invaded rocks were more or less pure calcareous (calc-granulites) homogenization towards a granitic composition could not be attained, the silica deficiency could not be made up, and nepheline syenites were formed. Presence of calcite, cancrinite, etc., should be expected in such an event, and the occurrence of calcite-bearing or "carbonatite" dykes could well be explained following Chayes.[3] The lineation in the nepheline syenite, on such premises, is a ghost of the original secondary lineation in the metamorphites.

Dept. of Geology, SAURINDRANATH SEN.
Calcutta University,
March 21, 1952.

1. Heron, A. M., *Rec. G. S. I.*, 1924, **56**. 2. Eckermann, H. von, *Internat. Geol. Congr. Proc. Sec. B*, Part III, 1948. 3 Chayes, F., *Bull Geol. Soc. Amer.*, 1942, **53**.

PIEDMONTITE FROM THE CHAMPION GNEISS NEAR ROBERTSONPET, KOLAR (MYSORE STATE)

AN interesting feature of the petrography of some specimens of the Champion gneiss[1] occurring at its contact with the hornblende schist, near Robertsonpet, is the development of a distinctly pleochroic mineral occurring mostly in conformity with the foliation of the gneiss. Microsections of the gneiss show the porphyroblasts of quartz and felspar with flakes of biotite in a groundmass which is full of black specks, probably manganese oxide. The quartz porphyroblasts show the original outline and also irregular cracks; but under the analyzer resolve themselves into granules of quartz showing aggregate polarisation, thus resembling the phenocrysts of the original quartz porphyry or rhyolite. The felspars are mostly microcline. The pleochroic mineral is now identified as piedmontite on the basis of the following optical characters.

The mineral occurs in radiating aggregates filling veins (Fig. 1) or in isolated patches

Occurrence of Piedmontite in radiating aggregates filling a vein in the champion gneiss near Robertsonpet, magnified × 40.

and thus resembles very closely the piedmontite from the Ancient Rhyolite of South Mountain, Pennsylvania (U.S.A.).[2] It has a high relief and shows the following pleochroism:

X = Pale lemon-yellow.
Y = Pale amethyst. X > Y > Z
Z = Pale red.

The birefringence of the mineral, as determined by the Berek's compensator is 0·029. It is optically positive with $X \wedge C = -5°$ and $2V = 80°$, as determined on the Federov's Universal Stage.

Piedmontite has not been so far noticed anywhere in Mysore and this is the first reported occurrence of this mineral. Further chemical and optical investigations are in progress.

Dept. of Geology, M. G. C. NAIDU.
Central College,
Bangalore,
July 5, 1952.

1. Smeeth, W. F., "Outline of Geological History of Mysore," Department of Mines and Geology, Mysore, State, *Bull.* No. 6, 1916, p. 20. 2. Williams, G. H., *American Journal of Science*, 1393, **45** (Third Series) No. 271. pp. 53 & 56.

ISOMERISATION OF THE DARK GREEN CHROMIC CHLORIDE HEXAHYDRATE IN ACETONE, A ZERO ORDER REACTION

In a previous communication, Datar and Kulkarni[1] reported that isomeric transformation of the dark green chromic chloride hexahydrate in aqueous solution is semimolecular.

Chesterman[2] noted the changes in resistance, which increased with time of solutions of the dark green chromic chloride in acetone at $25{\cdot}05 \pm 0{\cdot}05°$ C. The colour of the solution changed to purple. When changes in resistance are plotted against time, the points lie on a straight line up to about 80% conversion. From these values for two concentrations of chromic chloride, the time required for different fractions of the reaction completed are calculated and shown in Tables I and II. It is seen that

TABLE I

Concentration of $CrCl_3 = 0{\cdot}001512\ M$

% Transformation	Time Mins.	K_0
10	3·08	0·000049
20	5·4	0·000056
30	7·3	0·000062
40	9·03	0·000067
50	10·75	0·000070
60	12·65	0·000072
70	15·05	0·000070
80	17·45	0·000069
90	17·85	0·000068

TABLE II

Concentration of $CrCl_3 = 0{\cdot}02818\ M$

% Transformation	Time Mins.	K_0
10	5·77	0·00049
20	8·55	0·00066
30	11·74	0·00072
40	14·77	0·00076
50	17·80	0·00079
60	21·66	0·00078
70	25·59	0·00077
80	29·50	0·00076
90	38·2	0·00066

the reaction takes place with a constant rate, that is, x/t (or K_0) is constant, where x is the amount of the transformation expressed in gm. mol./litre and t is time in minutes. This shows that the reaction is of zero order. It is further seen that K_0 is not constant but increases with increase in chromic chloride concentration. When concentration is increased twentyfold, K_0 is nearly ten times greater.

Some other interesting facts which emerge from closer study of the data in the Chesterman's paper are (1) initial specific conductivity of chromic chloride in acetone solution is the same irrespective of concentration; (2) the transformation takes place with a relatively greater speed in acetone than in water. Further work is in progress.

We are grateful to Dr. Syed Husain for kind award of a scholarship to one of us (V. S. S.). We wish to express our sincere thanks to Dr. S. Husain Zaheer for kind encouragement.

Dept. of Chemistry, Osmania University, and Central Labs. for Sci. & Indust. Res., Hyderabad, Deccan,
April 30, 1952.

V. S. SUBRAHMANYAM.
D. S. DATAR.

1. Datar, D. S. and Kulkarni, D. R., *Curr. Sci.*, **1946**, **15**, 251. 2. Chesterman, D. R., *J. Chem. Soc.*, **1933**, **136**, 796.

THE USE OF AMMONIUM MOLYBDATE AS CATALYST IN THE ESTIMATION OF DICHROMATE

THE hydrogen peroxide-iodide and bromate-iodide reactions are catalysed strongly[1] by ammonium molybdate. The reaction

$$Cr_2O_7^{=} + 14\,H^+ + 6I^- \rightarrow 3\,I_2 + 2Cr^{+++} + 7\,H_2O,$$

is also catalysed by ammonium molybdate as shown below.

25 c.c. of 0·1 N $K_2Cr_2O_7$, 10 c.c. of 10 per cent. $NaHCO_3$, varying amounts of HCl followed by 25 c.c. of 12 per cent. KI solutions were taken in glass-stoppered bottles. The amount of HCl left over after reacting with $NaHCO_3$ in every experiment was more than enough for the reaction. The extent to which the reaction took place in each of the mixtures containing varying amounts of HCl was examined under three different conditions; (a) the immediate reduction with 8 drops of a 10 per cent. solution of ammonium molybdate, (b) the immediate reduction of $K_2Cr_2O_7$ which took place without catalyst, and (c) reduction after keeping for 5 minutes in darkness without catalyst; by titrating with standard thiosulphate solution after making the volume upto 400 c.c.

The results are given in Table I. Instead of the volume of thiosulphate required, the percentage of the dichromate reduced under different conditions has been given in the Table. All the experiments were tried in duplicate and these gave concordant results accurate to a

drop of thiosulphate. A perusal of the Table conclusively shows that ammonium molybdate

TABLE I

Volume of HCl (2N) in c.c.	Percentage of dichromate reduced		
	(*a*)	(*b*)	(*c*)
16	78	84	87
17	79	68	93
18	81	75	98
20	95	78	100
22	100	90	100
24	100	93	100
30	100	98	100

acts as a positive catalyst in the dichromate-iodide reaction.

My thanks are due to Professor B. Prasad for suggesting the problem.

Dept. of Chemistry, Ravenshaw College, Cuttack,
May 20, 1952.

D. V. RAMANA RAO.

1. Kolthoff and Sandell, *Quant. Inorg. Analysis*, 1947. Ed., 624, 630.

ELECTROCHEMICAL PROPERTIES OF HYDROGEN CLAYS FROM CONTIGUOUS BLACK AND RED SOILS FROM BHOPAL

A STUDY of the nature of electrometric titration curves and viscosity-alkali-concentration curves of hydrogen clays isolated from (1) different horizons of a black soil profile at Bhopal in which the lowest horizon was a reddish one, and (2) a surface reddish brown soil from the same locality, was taken up with a view to finding out the possible minerological composition of the clay, following the method of Mukherjee and co-workers.[1-5]

Titration curves, base-exchange capacity and viscosity alkali-concentration curves of the hydrogen clays.—Electrometric titration of the hydrogen clays from the first two horizons and the reddish brown horizon of the black soil profile with $Ba(OH)_2$ indicates a moderately strong monobasic acid character. The last reddish-brown horizon, however, shows stronger acid character than those of the upper two horizon. Similar also is the nature of the titration curve of the hydrogen clay from the surface reddish brown horizon. The base exchange capacities of the reddish brown clays are higher than those of the black clays as calculated from their titration curves. The figures are given in Table I.

TABLE I

Profile	Horizons	B. e. c. me/100 g.	pH at inflexion
I	0–12"	48	7·7
	12–67"	50	7·9
	260–261" (Reddish brown)	82	7·8
II	0·28" (Reddish brown)	76·5	7·8

The above results indicate that clay complex of black soils and the reddish brown soils are similar in electrochemical character and as shown by the previous workers, the nature of the curve and the high base exchange capacity indicate the presence of montmorillonitic type of mineral.

The viscosity–alkali concentration curve of the hydrogen clays from both the profile and the surface red-brown sample, showed a maximum at about 60 to 70 per cent. of the total neutralisation of the hydrogen clays. This is a characteristic of montmorillonitic type of minerals as has been shown by Mukherjee, *et al.* (*loc. cit.*).

The montmorillonitic nature of the clay complex is also borne out by the chemical composition of hydrogen clays. The silica-alumina ratios of all hydrogen clays vary from 3 to 4 and further there is a fair amount of non-exchangeable Mg (·2 to 1 per cent.) which is strongly indicative of montmorillonite; further these clays also contain an appreciable amount of non-exchangeable K_2O. This may either be due to the existence of any comminuted potash bearing mineral or an illitic mineral in the clay.

The above results indicate that in 'Rugur' or in the black soil, the brown layer which frequently occurs in the B horizon of the black cotton soil profile and also the red-brown soil which occurs frequently in black soil area are genetically of the same origin. The higher base exchange capacity of the clays isolated from the brown layer as compared to the black soils suggest that the brown horizon has weathered more than the black horizon. Mineralogical analysis of the sand fractions of the black and brown soils by Sen and Tamhane in this labo

ratory also indicate less amount of basic minerals present in the brown soil as compared to black soils. This also confirms that the brown soils are more weathered and more mature. From the electrochemical and electroviscous properties of typical yellow (Matassi) and red soil (Bhata) studied in this laboratory by one of the authors (Das), it is clear that all the red and yellow soils contain montmorillonite in their clay complex though they are dominantly kaolinitic in nature, particularly the yellow soil (Matassi) which contains a fair amount of montmorillonite. From this it appears that the black soils on continued weathering gives rise to the brown, yellow and red soils, the montmorillonites decomposing into the kaolinites during the weathering process.

Ind. Agric. Res. Inst., New Delhi,
April 22, 1952.

S. C. Das.
Ambadas Rao.
R. V. Tamhane.

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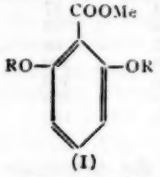
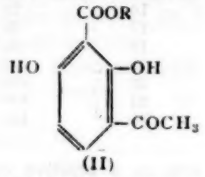
THE FRIES REARRANGEMENT OF ISOMERIC ACETOXY-RESORCYLIC ACIDS AND THEIR ESTERS

The Fries re-arrangement of the acyl esters of β-resorcylic acid and its methyl ester has been investigated by us.[1] We have now extended the above work to the investigation of the migration of isomeric α- and γ-resorcylic acids and their esters under the conditions of the Fries reaction. The di-acetate of α-resorcylic acid did not undergo the Fries reaction, only the de-acetylated product being recovered. This observation is in conformity with that of Mauthner;[2] and the non-migration of the acetoxy-acid is analogous to that of *m*-acetoxy-benzoic acid, which does not undergo the migration[3] and is in keeping with its abnormal behaviour in several other reactions.[4]

The di-acetate of methyl γ-resorcylate ($I: R = COCH_3$) on heating with anhydrous aluminium chloride at 110° gave a product to which the structure, methyl 2 : 6-dihydroxy-3-acetyl-benzoate ($II: R = CH_3$) has been assigned, as it is hydrolysed to the corresponding keto-acid ($II: R = H$) which on de-carboxylation gives resacetophenone. The migration at 150-55° gave only the keto-acid ($II: R = H$), hydrolysis occurring during the migration. The migration was also investigated under a variety of conditions : the same ketonic product ($II: R = H$ or CH_3) was obtained. It is interesting to note that only one of the migrating groups occupies a β-position of the resorcinol nucleus, although both of them are free, the other acetyl group being eliminated.



(I)



(II)

The migration of other acyl derivatives of unsubstituted and diversely substituted γ-resorcylic acids and their methyl esters is under progress.

M. R. Science Institute,
Gujarat College,
Ahmedabad,
June 16, 1952.

N. M. Shah.
G. C. Amin.

1. Amin and Shah, *J. I. C. S.*, 1952, **29**, 351. 2. Mauthner, *J. pract. Chem.*, 1933, **136**, 205. 3. Shah and Shah, *J. I. C. S.*, 1949, **26**, 235. 4. Mody and Shah, *Proc. Ind. Acad. Sci.*, 1951, **34A**, 77.

ANTI-TUBERCULAR ACTIVITY OF SESAMIN

The following communication deals with the anti-tubercular activity of sesamin,[1] one of the crystalline constituents of the unsaponifiable fraction of sesame (*Sesamum indicum*, Linn. N. O. *Pedaliaceæ*) oil.

In the Yunani system of medicine, the oil is mentioned to be useful for many ailments including dry cough, asthma and diseases of the lungs.[2]

In the present study, while sesamin has shown little activity against the common pathogenic bacteria like *Staphylococcus aureus*, *Streptococcus pyogenes*, *Bact. coli*, and *Bact. typhosum*, it has indicated activity against *Mycobacterium tuberculosis*, even in 1 : 1,000,000 dilution.

The sesamin for this purpose has been prepared according to the method of Tocher.[1] The procedure in brief is as follows :

The oil is shaken with glacial acetic acid, the acid layer separated and distilled. The thick residue is treated with warm dilute potassium hydroxide, shaken from time to time

and set aside for twelve hours in a conical flask. The supernatant liquid is siphoned off, and the deposited layer of sesamin washed several times with distilled water. It is then boiled with dilute hydrochloric acid, filtered, washed with water, and dried. Sesamin crystallises from alcohol in needle-shaped crystals, m.p. 121° C.

Sesamin in acetone solution is tested for its *in vitro* tuberculostatic activity in Youman's[3] synthetic liquid media using the virulent $H_{37}R_v$ strain (3-4 weeks old) of *Mycobacterium tuberculosis*, by the usual surface growth method.[4] The results at the end of each week for 3 weeks are presented in the Table.

TABLE

Antitubercular activity of sesamin

Week	Dilution of sesamin in the media							
	1/100	1/1000	$1/10^4$	$1/10^5$	$1/10^6$	$1/10^7$	Control with acetone only	Control
1st ..	–	–	–	–	–	–	±	+
2nd ..	–	–	–	–	–	±	+	+
3rd ..	–	–	–	–	–	+	+	+

– No growth. + Growth. ± Slight growth.

Thus it is seen that the compound has shown very good *in vitro* tuberculostatic activity. The easy availability of the raw material, the easy method of isolation of sesamin therefrom, and its favourable tuberculostatic activity would warrant further investigation of the usefulness of this substance in the treatment of tuberculous infection.

Further work regarding its stability, toxicity and *in vivo* activity is under progress.

Our thanks are due to Dr. K. P. Menon, Dr. M. Sirsi and Dr. A. S. Ramaswamy for their kind interest in the work.

P. R. J. GANGADHARAM.
N. L. NARAYANAMURTHY.
B. H. IYER.

Dept. of Organic Chemistry
and Pharmacology Labs.,
Indian Inst. of Science,
Bangalore-3,
August 14, 1952.

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A NEW CLASS OF FREE RADICALS

REVERSIBLE thermochromatic behaviour of certain organic compounds[1,2] has been attributed to the formation of free radicals on thermal agitation. But all the systems on record which show such behaviour are known to contain either aromatic nuclei or a disulphide bridge. It has now been observed by us that the absolute alcoholic and acetic acid solutions of the 'bromide' oxidation product[3,4] of tetramethyl thiocarbamide which has been shown to have a monomeric structure and not the disulphide one attributed to it earlier,[3] develop a deep yellow colour on warming, although, the cold solutions are completely colourless. Formation, *inter alia* of Weitz's aminium type[5] free radicals from the above substance has been already suggested by one of us.[6] The reversible thermochromatic behaviour now observed supports this view. The present case is of special interest in view of the completely non-aromatic character of the substance, its saline nature and the observed thermochromasy in partially ionizing media. The detailed paper will be published elsewhere.

Dept. of Chemistry, R. H. SAHASRABUDHEY.
College of Science, (MISS) INDUMATI BOKIL.
Banaras Hindu University,
April 30, 1952.

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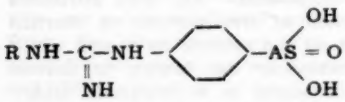
SOME GUANIDO-ARSENICALS AS POSSIBLE ANTI-MALARIALS

THE use of organo-arsenical[1,2,3,4] drugs in malaria therapy is well known. In our previous communication[5] several biguanido-arsenicals have been reported. When they were tested against *P. gallinaceum* in chicks, they did not show any appreciable activity.[6] With a view to studying the pharmacological properties of guanido-arsenicals, it was considered to be of interest to prepare new compounds containing guanidine residue as also the arsonic acid in the molecule of Type I. The compounds of this type were prepared by reacting p-arsanilic acid with the appropriate cyanamides in pyridine medium. After removal of pyridine by steam distillation the products was crystallised from alcohol and characterised.

The following compounds of type I have been synthesised :



Type I.

Where R = alkyl, aryl or sulphonamides.

No.	R in compounds type I	M.P. ° C.
1	*p*-Cl—C_6H_4— ..	180 (*d*)
2	*p* Br—C_6H_4— ..	125 (*d*)
3	C_6H_5— .	135 (*d*)
4	$CH_3 \cdot C(=N)$—$HC(=CH)$—$C \cdot NH \cdot SO_2C_6H_4$—	Turns black above 300° C.
5	NH_2—C(=NH)—NH—$SO_2C_6H_4$—	150 (*d*)
6	*p*-$CH_2C_6H_4$— ..	160 (*d*)
7	CH_3 \ CH— / CH_3 ..	Above 300
8	CH=N— / CH / C—NH·$SO_2C_6H_4$— .. (S)	Turns brown at 223°

The sodium salt of the acids were prepared by the usual way. None of these compounds when tested against experimental malaria have shown any activity.

Full details will be published elsewhere.

Dept. of Organic Chemistry, Indian Inst. of Science, Bangalore-3, *July* 11, 1952.

J. R. Guha.
S. S. Guha.
A. C. Roy.
P. C. Guha.

1. Goldman, *Amer. J. Med. Sc.*, **1938, 196,** 502. 2. Sinton, *Indian J. Med. Res.*, **1927, 15,** 287. 3. Steward, V. S., *Nav. Med. Bull.*, **1945, 43,** 991. 4. Puyal, *et al., cf. Recent Advance in Chemotherapy*, J. and A. Churchill London, **1930,** p. 100. 5. Roy and Guha, *J. Sc. and Ind. Res., V*, 1950, **9B,** No. 10, 242. 6. Roy, *et al. (under publication)*.

CHLOROPHYLL DEFICIENCY IN *STRIGA*

Striga seedlings deficient in cholorophyll were first seen in the summer (1950) crop of *Cholam* (*Sorghum*) heavily infested with *Striga* at the Millet Breeding Station, Coimbatore. Two such seedlings were observed. One of them with white leaves, emerged above the ground and then dried up, while the other with yellowish leaves grew to a height of 7 cm. and then dried up completely. A similar experience was met with in the main season of 1951, when two *Striga* seedlings with yellowish leaves were observed. These also grew to a height of about 7 cm. and dried up without flowering. Both types of chlorophyll deficiencies are lethal. The occurrence of mutations for chlorophyll deficiency in crop plants is not uncommon and many instances of such albinos and yellows have been often reported in *Sorghum*, rice, wheat and other cereals. Their occurrence in partially parasitic green plants like *Striga* is rare and the report of such occurrence is made in this paper.

Millets Breeding Station, Coimbatore, *May* 10, 1952.

K. Meenakshi.
P. Krishna Rao.

PHARMACOLOGICAL STUDY ON A GROUP OF 4-PIPERIDONE DERIVATIVES FOR THEIR SPASMOLYTIC PROPERTIES

In continuation of our earlier studies on the spasmolytic properties of 3-methyl isoquinoline compounds,[1] the following 4-piperidone compounds were tested for their spasmolytic properties using the same technique. The chemical formulæ of these compounds are given below :

1. 2, 6-di-(2′-methoxy)-phenyl-3, 5-dimethyl-4-piperidone HCl.
2. 2, 6-di-(3′-methoxy-4′-hydroxy-phenyl-3-methyl-4-piperidone, HCl.
3. 1, 3, 5-trimethyl-2, 6-diphenyl-4-piperidone, HCl.
4. 2, 6-di-anisyl-3-methyl-4-piperidone, HCl.
5. 2, 6-di-anisyl-3-carbethoxy-4-piperidone, HCl.
6. 2, 6-diphenyl-3, 3, 5, 5 -tetramethyl-4-piperidone, HCl.
7. 1, 3-dimethyl-2, 6-di-anisyl-4-piperidone, HCl.

Compound 1 in doses of 40 mg. was able to relieve the spasm produced by 0·25 mg. of histamine. Compound 2 in doses of 100 mg. was able to annul the effect of 0·25 mg. of histamine. Compound 7 in doses of 200 mg. was able to relieve the spasm produced by histamine partially. Higher doses could not be tried as the drug was too toxic. This meant that 10 mg. of papaverine HCl equalled 40 and 100 mg. of compounds 1 and 2 respectively for spasmolytic action. But they were not found to be supe-

rior to papaverine in potency, nor had they any effect on respiration.

V. ISWARIAH.
Dept. of Pharmacology, V. S. VENKATA SUBBU.
Madras Medical College,
July 12, 1952.

1. Iswariah, V. and Venkata Subbu, V. S., *Curr. Sci.*, 1952, **21**, 131.

SOLANUM JASMINOIDES VIRUS

A NEW virus has been isolated from *Solanum jasminoides* Paxt. It behaves in many respects like potato virus 'Y' but differs from it in certain important respects. On *S. jasminoides* it usually produces a fleeting type of mottle. By sap inoculation on young seedlings of *Nicotiana tabacum* (White Burley), the first symptoms are a complete and irrevocable collapse of the lower leaves, about 4 to 5 days after inoculation. In another two days' time the vein clearing appears which is followed by appearance of first necrotic specking and later necrotic banding along the veins. The collapse of the leaves is due to extensive phloem necrosis near about and below the collar region of the stem. On *Nicotiana glutinosa* mottling is the only symptom exhibited.

On young plants of *Solanum nigrum* fleeting but distinct vein clearing appears within 7-10 days after inoculation. This is followed by extensive and prominent vein banding. In infected plants the flowers may show very marked structural changes. The normal rotate shape may be transformed into a stellate type with long linear petals. The anther lobes are often reduced and may be represented by small vestige of brownish tissue at the tip of filaments. The disease can also be transmitted by sap inoculation to *Hyoscyamus niger*, *Petunia* and *Lycopersicum esculentum*. In the former case, collapse of lower leaves and fleeting type of vein clearing appears while in the later two plants only mottling results.

Unlike potato virus 'Y' the virus is not transmitted by sap inoculation or grafting to *Solanum nodiflorum* or potato (varieties Craig's Defiance, Arran Victory and Majestic). *D. tatula* and *Capsicum annuum* are immune.

Dilution end point of the virus lies between 1 : 1,900 and 1 : 2,000. The virus retains its infectivity for 24 to 48 hours at room temperature (23° to 27° C). One hour's exposure to 50 per cent. alcohol competely inactivates the virus; its thermal inactivation point is 60° C.

Cross immunity tests with virus 'Y' have shown that virus 'Y' often gives protection against *Jasminoides* virus. This protection is, however, not absolute as sometimes, particularly in tests with young seedlings, the immunity reaction has been observed to break down.

It is of interest to mention that *S. jasminoides*, an ornamental climbing shrub growing all over Simla, is originally a native of South America. Plants of *S. jasminoides* in different localities at Simla and round about were analysed for virus content and all the shrubs, without exception, were found to carry the virus. This would suggest that the virus was probably originally introduced with the plant material from South America. It is significant in this connection to mention that *S. jasminoides* is self-incompatible and stocks growing round about Simla have never been seen to set seed.

Central Potato Res. Inst., PUSHKARNATH.
Patna,
April 26, 1952.

VERNALISATION OF CABBAGE SEEDS (*BRASSICA OLERACEA* VAR. *CAPITATA*)

CABBAGE generally does not flower or seed in the plains of Uttar Pradesh. Even if a few varieties may flower, they fail to produce pods and seeds as flowering occurs late in the season when temperature is too high for their development. This handicaps any breeding programme seriously. Besides, cabbage growing in plains is wholly dependent on imported seeds resulting in a financial loss to the country.

Cabbage seed introduction and acclimatisation trials, with 23 varieties from Indian and foreign sources revealed that a number of them could produce seeds in one year by proper manuring and culture, at this Station. But early large drum-head variety, with attractive colour and desirable qualities of head, failed to respond to such treatments. Cabbage is reported to produce seed in one year following vernalization, at times.[2] The seeds of this variety were, therefore, vernalised by the authors to induce earliness in flowering, so that the seed development may be complete before the onset of high temperature period during the months of May and June.

The seeds of early large drum-head variety (Pocha's) of cabbage were vernalised at 32° and 45° F. for four weeks after providing them moisture at 50 per cent. by weight of the seed. The seeds after treatment were sown in pots and 43-days-old seedlings which had develop-

ed 4 leaves each, were transplanted in micro-plots. Sixteen plants were transplanted for observations, under each treatment. The plants received 2 oz. superphosphate per plant per month and were irrigated regularly. The results are given in Table I.

TABLE I

Showing responses of cabbage, early large drum-head variety (Pocha), to vernalisation

Treatments	Days after transplanting, appearance of				
	Head	Buds	Flowers	Pods	Seed ready
Control ..	113	..	..	..	..
*32° F. ..	113	150	169	189	213
45° F. ..	113	200	..	..	..

* Nine plants out of sixteen formed pods, and 7 formed seeds.

It would be clear from the Table that plants obtained from untreated seeds as well as those vernalised at 45° F., failed to form seeds, in the latter case buds were observed 200 days after transplanting when they could not form seeds. The flowers formed pods and seeds even when bagged at bud stage, showing no self-sterility in this variety; which is reported to occur in some varieties of cabbage.[1]

Grateful thanks are due to Dr. L. B. Singh for his continued interest in the work and helpful suggestions.

Govt. Fruit Res. Station, Saharanpur, U.P., India,
May 27, 1952.

N. N. DIKSHIT.
U. P. SINGH.

1. Kakizaki, Y., *Jap. Jour. Bot.* **5**, 135–208. (*Bio. Abs.* **5**, No. 13451.) 2. Beljenkova, A. F., Korjakina, V. F., and Smetanikova, A. I., *Sovetsk. Bot.*, 1945, **13**, 5, 29–35. (*Russian*) *Eng. Summary from Horticultural Abstracts.*

OCCURRENCE OF A NEW RACE (No. 122) OF *PUCCINIA GRAMINIS TRITICI* IN BOMBAY STATE

WHILE examining a few rust samples from Bombay State for the presence of biotypes of race 42 of *Puccinia graminis tritici*,[2] it was observed that one sample from Bagalkot, collected in January 1952, produced type-4 infection on Yalta, a wheat variety which serves as a differential host for race 42B. The reactions of Reliance and Khapli were, however, not typical of race 42B. Reliance is immune to race 42B, while it is susceptible to the sample from Bagalkot. A new race was suspected and further study has shown that the reactions of the twelve differential wheat varieties are, according to Stakman's key,[1] very much like those of race 122, Reliance being susceptible and Kota immune. None of the present Indian races of stem rust of wheat produces this particular set of reactions.

A few rust resistant varieties of wheat, mainly those used for hybridization by breeders in Bombay and Madhya Pradesh, were tested against this new race and varieties such as Charter, Gabo, Gaza, I.36.32.13.2.1.2 and C.14112 were found resistant to it, as to others. Strain 88, which is almost immune to other races, shows infection types 1 and 2 against the new race and the reaction of E.220 consists of types 2 and 3.

Wheat Rust Station, Mahabaleshwar,
June 4, 1952.

V. P. GOKHALE.
B. P. PATIL.

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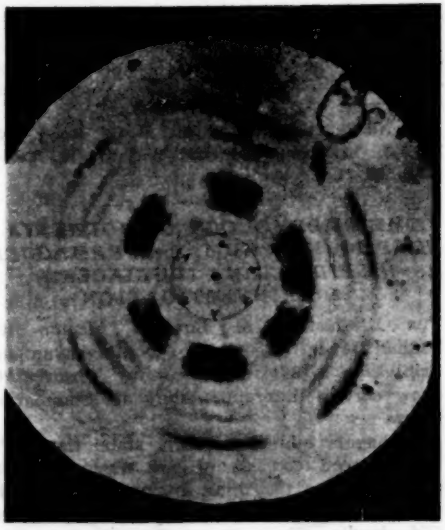
AMINO ACID MAKE-UP OF VEGETABLE MILK

THE circular paper chromatographic technique[1] developed in this laboratory was made use of for the separation and identification of the different amino acids present in a sample of vegetable milk processed in this laboratory. Dehydrated and defatted vegetable milk was hydrolysed by autoclaving with 6 N hyrochloric acid for 6 to 7 hours. After removing the hydrochloric acid by repeated evaporation, the pH was adjusted to 6·8 to 7·0 by the addition of sodium hydroxide. The solution was then made up to a known volume.

For the identification of the amino acids, the hydrolysate and a known mixture of amino acids were spotted side by side on a Whatman No. 1 (15 cm. diam.) filter paper. The chromatogram was developed as described by Giri, *et al.*[2] The chromatogram showed that the vegetable milk contains practically all the amino acids.

It was of interest to compare the chromatogram obtained with vegetable milk with that of cow milk. Cow milk was, therefore, treated in the same manner as outlined for the vege-

table milk and the two hydrolysates were spotted side by side on equal nitrogen basis. The chromatogram obtained is given in Fig. 1. A



Circular paper chromatogram showing the amino acid composition of vegetable milk and cow milk.

study of the chromatogram shows that all the bands obtained in the case of cow milk hydrolysate are also present in the vegetable milk hydrolysate. The colour intensities of the different bands are also nearly equal. This observation as also the other experiments (under publication) to determine the nutritive value of the vegetable milk would serve to give convincing evidence concerning the nutritive quality of the vegetable milk.

We wish to express our thanks to Prof. K. V. Giri for his keen interest in the progress of the investigation.

Dept. of Biochemistry, D. K. NANDI.
Indian Inst. of Science, R. RAJAGOPALAN.
Bangalore-3,
June 19, 1952.

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THE OCCURRENCE OF A BLOOD-ANTICOAGULANT FACTOR IN THE LATEX OF *CARICA PAPAYA*

THE action of papain in accelerating the clotting of blood has been studied extensively.[1-4] On the other hand, no work has so far been reported on the occurrence of a factor in papaya latex, which prevents the clotting of blood, except the recently reported finding of Kopaczewski[5] who observed that the latex of *Carica papaya* accelerates the coagulation of blood when used in small concentrations and retards it at higher concentrations.

We have been able to fractionate from the acetone-dried powder of papaya latex two factors, one which accelerates, and another which prevents the clotting of blood. A 2% solution of the acetone-treated latex was prepared in distilled water and centrifuged to remove the suspended matter. The clear supernatant was fractionated with the appropriate addition of solid ammonium sulphate and the precipitates obtained in each case redissolved in distilled water and made up to the original volume. The solutions were dialysed at 0° C. till all traces of ammonium sulphate were completely removed. Three volumes of acetone were added to the dialysate and the precipitate obtained centrifuged off and dried.

The precipitates were dissolved in the same volume of distilled water as the original extract used for fractionation and blood-clotting experiments were carried out using bovine plasma and Russel's viper venom as the source of thromboplastin according to Rahman and Giri.[6] The results of a typical experiment are given below:

Fraction	Clotting time in secs.
0·5 saturation ..	240
0·75 saturation ..	18
Full saturation ..	24
Control ..	24

It is seen from the above Table that the clotting inhibitor is precipitated at 0·5 saturation of ammonium sulphate and the accelerator at 0·75 saturation.

The clotting inhibitor is also found to prevent completely the clotting of whole blood (human).

The anti-coagulant is heat-labile. In the dry form it can be preserved for some time, but it loses its activity on long standing in aqueous solutions. Work on the purification and chemi-

cal nature of the anti-coagulant is in progress. Details of the work will be published elsewhere.

Dept. of Biochemistry, Indian Inst. of Science, Bangalore,
August 1, 1952.

T. RAMAKRISHNAN.
N. C. PILLAI.
K. V. GIRI.

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PRESERVATION OF PAPER CHROMATOGRAMS

THE rapid fading of ninhydrin stained amino acid bands on filter-paper after development of the chromatogram is one of the chief disadvantages for visual comparison and quantitative estimation of the amino acids separated by paper chromatography. For the preservation of chromatograms previous workers have suggested coating the surface of the paper with various materials[1] and treatment with copper nitrate.[2]

We found that coating of the chromatograms with collodion, gelatin, methyl methacrylate polymer, "Perspex" in chloroform and paraffin wax did not prove satisfactory as the colours faded in a short time. Treatment with copper nitrate altered original colours of the bands.

We have found the paper chromatograms retained their original colours when kept in a dry atmosphere. Keeping the chromatograms immediately after developing the colours of the bands with ninhydrin without any previous treatment of the paper in a vacuum desiccator over anhydrous calcium chloride was found to preserve the tone and colour intensity of the bands for more than two months without visible alteration in colour while the chromatograms kept exposed to air faded within a week. Preservation in dry nitrogen atmosphere or at low temperature in closed containers was also found to be effective. The observations point out that the fading is due mainly to atmospheric oxidation in presence of moisture which appears to be very slow at low temperatures. This simple method of preservation of paper chromatograms has obvious advantages over the other methods. In addition to its value for stabilising the original colours its simplicity should make it specially useful in paper chromatographic analysis.

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T. A. VENKATASUBRAMANYAN.
K. V. GIRI.

Dept. of Biochemistry,
Indian Inst. of Science,
Bangalore-3,
July 15, 1952.

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THE EMBRYOLOGY OF *BORRERIA HISPIDA* K. SCHUM. (=*SPERMACOCE HISPIDA* LINN.) (RUBIACEAE), A REINVESTIGATION

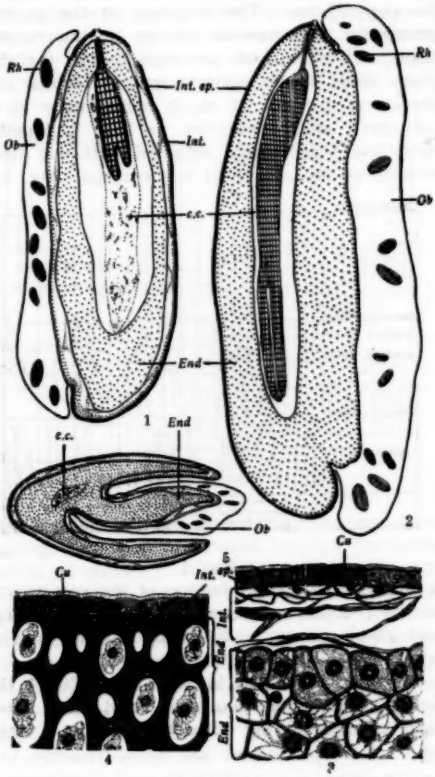
THE life-history of *Borreria hispida* was studied several years ago by Raghavan and Srinivasan (1941).[1] Since my observations show certain differences, they are summarised below.

Raghavan and Srinivasan state that "The mature seed consists of the remains of the strophiole and the thick integument, the latter of which does not perish as in *Dentella* and *Oldenlandia*. The cells of the integument become thick-walled and the seed thus is very hard ultimately. There is no endosperm surrounding the embryo'.

As a result of a thorough developmental study, I find this statement to be incorrect. After fertilisation, the zygote remains quiescent and the primary endosperm nucleus divides rapidly by free-nuclear division. The first division of the zygote takes place when about 200 nuclei have been formed in the endosperm. The endosperm forms a compact mass surrounding the developing embryo. Generally, after the embryo assumes the sphere stage, consisting of about 40 cells, walls are laid down in the endosperm mass enclosing one nucleus in each cell. The embryo remains in direct contact with the surrounding endosperm cells until the differentiation of the organ begins. At the time of initiation of the cotyledons, the part of endosperm in the vicinity of the embryo breaks down and a cavity is formed, in which the embryo lies free, bathed in the nutritive substance produced by the disorganisation of the central mass of the endosperm tissue (Fig. 1).

The outer zone of the endosperm cells, on the other hand, is characterized by having comparatively thicker walls, dense cytoplasm

and prominent nuclei. The endosperm tissue goes on encroaching upon the integumentary cells which become highly vacuolated and their nuclei appear in a degenerating condition (Fig. 3). Ultimately, the whole mass of the endosperm consists of highly thickened cells with only a small amount of cytoplasm (Fig. 4). The thick-walled tissue interpreted by Raghavan and Srinivasan (1941) as the integument is, therefore, really a part of the endosperm.



FIGS. 1–5. *Borreria hispida* K. Schum. FIG. 1. L.s. of young seed (*Ob.*, Obturator; *Rh.*, Raphides; *Int. ep.*, *Integumental epidermis*; *Int.*, Degenerating integumentary cells; *C.C.*, Central cavity of endosperm; *End.* Endosperm). × 20. FIG. 2. L.s. of mature seed, × 20. FIG. 3. Detailed structure of a portion of the seed in Fig. 1 (*Cu.*, Cuticle). × 150. FIG. 4. Detailed structure of a portion of the seed in Fig. 2, × 150. FIG. 5. T.s. of a seed showing the invagination of endosperm into the obturator, × 2.

Another interesting point is the invagination of the endosperm into the so-called obturator or strophiole. In the beginning the cells of the obturator contain a considerable quantity of starch. The endosperm gradually encroaches upon these cells and consumes the entire central tissue (Fig. 5).

The seed in mature condition consists of the fully developed embryo, the endosperm, the remains of the obturator and the integumental epidermis. The last forms a very hard covering (Fig. 2). The statement that there is no endosperm surrounding the embryo is obviously incorrect.

I am grateful to Prof. P. Maheshwari who suggested this study and helped me in writing the account. I am also indebted to Mr. Reayat Khan and Dr. B. M. Johri for their guidance and advice.

Dept. of Botany, MOHD. FAROOQ.
Aligarh Muslim University,
May 24, 1952.

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OCCURRENCE OF TRANSAMINASE IN THE SILKWORM, *BOMBYX MORI* L.

TRANSAMINASE has been suspected to be functionally associated with protein synthesis. Its possible role in the synthesis of proteins in plants, has been discussed by Virtanen and Laine,[1] Cohen and Albaum,[2] Von Euler,[3] and Braunstein.[4] Its obvious function for which a substantial amount of critical experimental support exists is, however, the interconversion of the essential metabolites associated with intermediary nitrogen metabolism.[5] Shoenheimer and his associates[6] have suggested the reversibility of the reaction involving the transfer of amino groups from peptide chains and amino acids to suitable amino acid acceptors with the formation of α-keto acyl derivatives of peptides. Such transfers are believed to account in part for the rapid exchange of dietary amino nitrogen of a single amino acid with all amino acids of body proteins. Its participation in the synthesis of amino acids and peptides has been demonstrated by a number of investigators.[7,8,9]

Transaminase activity has been shown to occur in animals,[10] plants[11] and micro-organisms.[12] Conflicting statements have been made with regard to the relationship between transaminase activity and proliferating tissues and secretory glands characterised by rapid protein synthesis.[2,4] Much of the earlier work on this enzyme system has been vitiated by the un-

satisfactory analytical method employed. The paper chromatographic technique has furnished an elegant method of analytical approach for a study of this enzyme and this has been very successfully employed by Feldman and Gunsalus[12] in their study of bacterial transaminases.

We have undertaken a study of the transaminase systems associated with the tissues of the silkworm, particularly the hæmolymph and the gland which constitute sites of intense protein metabolism. Papyrographic method of analysis has been employed for the separation and characterisation of the products of the enzymatic reaction.

Experimental.—Well-fed, disease-free silkworms in their fifth instar (four days after the fourth moult), were employed for the preparation of the enzyme extracts. The hæmolymph was collected by pricking the larvæ by means of a fine capillary and diluted with twice its volume of M/15 phosphate buffer, pH 7·4. The larvæ were then dissected out to secure (*a*) the tissues of the intestinal tract, and (*b*) the silk gland. These were then separately ground up with 10 volumes of M/15 phosphate buffer (pH 7·4) in an all-glass homogenizer with a small quantity of 100 mesh glass powder. All the operations outlined above, were carried out at 5-10° C.; the enzyme extracts were stored in a refrigerator (0° C.) with a layer of toluene. The reagents for the study of transaminase activity consisted of (i) 1·0 M asparate (Pfansteil) solution in M/15 phosphate buffer pH 7·4, (ii) 0·068 M α-keto glutarate (B.D.H.), and (iii) 0·1 per cent. solution of calcium pyridoxal phosphate, which served as the co-enzyme. The reaction mixtures were compounded as given in Table I.

TABLE I

	1	2	3	4	5	6	7	8	9	10
Phosphate buffer M/15 pH 7·4 ml. ..	0·1	0·2	0·3	0·4	0·3	0·2	0·1	0·3	0·2	0·2
Pyridoxal phosphate ml. ..	0·1	0·0	0·0	0·0	0·1	0·1	0·1	0·0	0·1	0·1
α-ketoglutarate ml. ..	0·1	0·1	0·0	0·0	0·0	0·1	0·1	0·1	0·0	0·1
L-asparate ml. ..	0·1	0·1	0·1	0·0	0·0	0·0	0·1	0·0	0·1	0·1
Enzyme extract ml. ..	0·1	0·1	0·1	0·1	0·1	0·1	0·1 (boiled)	0·1	0·1	0·0
Total volume ..	0·5	0·5	0·5	0·5	0·5	0·5	0·5	0·5	0·5	0·5

The reaction mixtures were incubated at 37° C. At the end of 18 hours, an aliquot of 2·5 µl. of each of the reaction mixtures was employed for spotting on Whatman No. 1 filter-paper. The method of development of the papyrogram and the development of the colour by the ninhydrin reagent were similar to those described earlier,[13] except for the developing solvent which consisted of Butanol-formic (95%)-H_2O in the ratio of 10 : 2 : 5. This solvent system was found to effect a better separation of aspartic and glutamic acids on the papyrogram. The diagrams of the papyrograms for the various sources of the enzyme (only a few controls are included in the diagram since others gave negative results and, therefore, are not of much significance to be included) are reproduced in Fig. 1, together with the papyrogram obtained with rat heart muscle as the source of the enzyme. Fig. 2 is

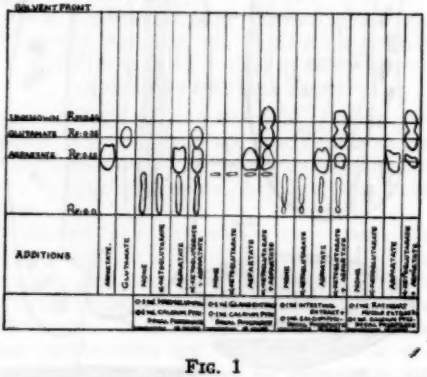

FIG. 1

a diagrammatic reproduction of the papyrogram of the reaction mixtures with intestinal extract and gland extract as the source of the enzyme, spotted at different intervals of time.

Discussion.—It will be seen from Fig. 1 that hæmolymph, the glandular and the intestinal extracts of the silkworm contain a transaminase capable of mediating the transfer of the amino group of aspartic acid to α-ketoglutaric acid. Controls in absence of the combined presence of aspartate and α-ketoglutarate, do not give any glutamic acid spot (Rf value 0·35). While in the case of hæmolymph

a single spot of glutamic acid is obtained as the result of enzyme activity, a second spot in addition to the glutamic acid spot appears in the case of three reactions carried out with glandular and intestinal extracts of the silkworm and with the extract of the heart muscle of the rat. This additional spot which has an Rf value of 0·42 must be taken to represent a peptide which is the product of enzymatic transpeptidation known to be associated with such enzyme systems.[14]

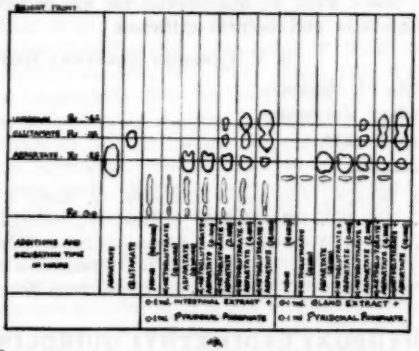

FIG. 2

Fig. 2 gives a diagrammatic reproduction of the papyrograms carried out with reaction mixtures spotted at different intervals of time. It will be seen that in the case of the intestinal and glandular extracts, there is progressive decrease of the aspartate spot which is accompanied by a corresponding increase of the enzymatically formed glutamate. In the course of these studies we have observed that the transaminase activity is higher in the case of the glandular and intestinal extracts while the hæmolymph exhibit a comparatively low activity.

These transaminase studies are being extended to other amino group donors (amino acids) and α-keto acid acceptors.

Our grateful thanks are due to Professor M. S. Thacker, Director, Indian Institute of Science, for providing us excellent facilities for our work and for his kind interest in these investigations. We are indebted to the Government of Mysore and to the Government of India for financial support. Our thanks are also due to Messrs. D. Shankaranarayana and B. S. Shankarappa for their valuable co-operation in the course of these investigations.

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ISOLATION OF A NEW SAPONIN AND SAPOGENIN, ALBIZZIAGENIN, FROM *ALBIZZIA LEBBEK*, BENTH. (N. O. LEGUMINOSAE)

WITH reference to the report by N. D. Ghatge and N. M. Shah[1] that saponin had been detected in the seeds of *Albizzia lebbek*, we wish to report that saponin from the pericarp of the beans of *Albizzia lebbek*, Benth. has been obtained by us as a creamy powder, m.p. 115°-20° C. It answers to all the tests of saponin: in very high dilutions it shows a high hæmolytic activity on the red blood corpuscles,[2] accelerates germination and growth of wheat seeds (communication in press) and foams copiously in water. The sapogenin obtained from it has m.p. 316° C. and composition $C_{27}H_{42}O_4$. Its properties differ very much from all the known sapogenins of this formula.[2,3] Therefore, the authors have named it Albizziagenin. A number of its derivatives have been prepared to support it. The seeds and the bark have also been examined and saponin obtained from them. Fuller details will appear elsewhere.

Dept. of Chemistry, Muslim University, Aligarh, *August* 6, 1952. I. P. VARSHNEY. M. O. FAROOQ.

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FERRIFEROUS DIOPSIDE (*SALITE*) FROM GOTIVADA, VIZAGAPATAM DISTRICT

IN the manganese pit at Gotivada (Long. 82° 44′; Lat. 17° 33′), greenish pyroxenes are seen in association with the ore body. The pyroxenes occur as big crystals interpenetrated into one another in the manganese ore. A specimen was found to have the following properties:

Megascopic characters.—Colour, green; occurrence, as big blades; fracture, even; hardness, 5 to 6; streak, none; alteration, to serpentine.

Microscopic characters.—Idiomorphic; has two sets of cleavages set at 92°; slightly pale green; no pleochroism; biaxial and positive; Z to *c* 44°; 2 V is positive 62°; twinning observed in a few grains; associated with biotite, manganese ore and brownish pyroxene (an alteration product of green pyroxene).

Chemical Analysis.—The following percentage values were obtained by analysis: SiO_2 52·36; Al_2O_3 00·07; Fe_2O_3 1·89; FeO 8·74; MnO 00·23; CaO 24·43; MgO 13·06; H_2O 0·22. These give molecular numbers 0·886 RO, 0·013 R_2O_3; 0·873 SiO_2. The formula very nearly resolves to RO. SiO_2 type.[1] The smaller amounts of Fe_2O_3 and MnO are presumed to be present as impurities in the form of magnetite, etc., and deducting these the following percentage values were obtained for the normative minerals Wo 49·4; Fs 37·0; En 13·6.

When plotted on the En-Wo-Fs trilinear diagram,[2,3] these values yield a point falling on the Diopside-Hedenbergite line and in the field marked by Salites, a ferriferous variety of Diopside. The ratio between Diopside and Hedenbergite is 72·4 : 27·6, or the mineral nearly consists of 75 parts of Diopside with 25 parts of Hedenbergite.

From the graph given by Winchell[4] relating to the chemical composition and optical characters, the 2 V value for a mineral of this composition approximates to 61° which very closely agrees with the observed value of 2 V, 62° (pos). Z to *c* value which is 44° corresponds to that calculated from the graph.

It is interesting to note that Fermor[5] describes pyroxene from Tadur, Kodur, Chintalavalasa areas in Vizag District for which the optical data given by him agrees with the values obtained by the present writer on the pyroxenes at Gotivada. Fermor has not given any chemical data. He surmised that they may be manganiferous pyroxenes but this is not supported by the analytical values.

Genesis.—The pyroxenes are found in the deposit which is associated with the khondalites. The preponderance of calcium and magnesium shows that the manganese is precipitated as a sediment along with the impure calcareous sediments. The dolomites in course of metamorphism probably interacted with the available silica giving rise to minerals of diopside-hedenbergite group which were later partially altered to brown types of pyroxenes, members of Schefferite series.

I thank Prof. C. Mahadevan for his valuable suggestions and helpful criticism.

S. V. LAKSHMI NARAYANA RAO.

Dept. of Geology,
Andhra University,
July 2, 1952.

1. Dana, S., *Text Book of Mineralogy*. 2. Barth, T. F. W., *Am. Min.*, 1931, **16**, 195. 3, Hess, H., *Ibid.*, 1941, **26**, 515. 4. Winchell, A. N., *Elements of Optical Mineralogy*, Pts. I and II. 5. Fermor, L. L., "Manganese Ore Deposits in India," *Mem. Geol. Surv. Ind.*, 1909, **37**.

4-HYDROXY 2:5 DIMETHYL QUINOLINE AND 4-HYDROXY 2-METHYL 5-CHLORO QUINOLINE

BY the method of Conrad and Limpach,[1] Spivey and Curd[2] cyclised ethyl β-arylamino crotonate of *m*-toluidine to give a mixture of two isomers, *viz.*, 4-hydroxy 2 : 7 dimethyl quinoline and 4-hydroxy 2 : 5 dimethyl quinoline. They were separated in the form of their oxalates. In the case of *m*-chloroaniline crotonate, however, the 7-isomer only, *viz*, 4-hydroxy 2-methyl 7-chloro quinoline could be isolated in the form of its picrate...

By using acetic anhydride-sulphuric acid reagent, a method has been developed in this laboratory to cyclise the crotonates. It has the peculiar advantage of giving in both the above cases 5-isomers only, *viz.*, 4-hydroxy 2 : 5 dimethyl quinoline (m.p. 274° C., yield = 73%; m.p. reported by Spivey, 278° C.) and 4-hydroxy 2-methyl 5-chloro quinoline (m.p. 261°-62° C., yield = 40%). Cyclisation of crotonates could be effected easily at room temperature, without external heating, as heat of reaction alone was sufficient for the purpose. The details will be published elsewhere.

M. T. B. College, B. P. BANGDIWALA.
Chemistry Department, C. M. DESAI.
Surat, *July* 19, 1952.

1. Conrad and Limpach, *Ber.*, 1887. **20**, 947. 2. Spivey and Curd, *J.C.S.*, 1949, 2656.

DETECTION OF MOLYBDENUM—IMPORTANCE OF HYDROGEN ION CONCENTRATION

THE reduction of hexavalent molybdnum salts in acid medium to molybdenum blue was observed by Berzelius and the colloidal nature and the composition as $Mo_8O_{23}xH_2O$ were attributed by Schirmer.[1] The KCNS reaction observed by Braun[2,3] is cited as one of the most sensitive methods for the detection of Mo. The constitution of the substance responsible for the red colour is not known with certainty. By studying the co-ordination compounds of pentavalent molybdenum with NH_4CNS, James and Wardlaw concluded[4] that the red colour is due to the formation of $R_2[MoO_2(CNS)_3]$. The influence of the hydrogen ion concentration on their formation was not studied in the above investigations. Recent work[5,6] on molybdenum-thiocyanate complex also does not deal with this aspect.

In the experiments now performed, a 10% aqueous solution of ammonium-molybdate, saturated solution of H_2S (as a reducing agent), near about 2 N solution of pure KCNS were used. The reactions were studied between pH 1 and 6 using sodium acetate-hydrochloric acid buffer solutions and also with 1-12 N hydrochloric acid. Other things remaining constant, brown colour appeared between pH 3 and 6; green and blue at pH 2 and 1 respectively. The blue colour was unstable at higher acid concentrations. The red colour in the sulphocyanide reaction is obtained only at and above 2 N, and below this normality the unchanged Mo-blue is noticed. The colour changes are pH-reversible. This has been well verified by developing the red colour first and then reducing the acidity by various methods.

It is thus evident that hydrogen ion concentration exerts a marked influence on the above two principal qualitative tests for Mo and the pH has to be carefully controlled for the successful detection of Mo. Work is in progress to explain this behaviour in the light of the isopolyacid formation indicated by Jander and others.

Dept. of Chemistry, Ravenshaw College, Cuttack, *June* 17, 1952.

D. V. RAMANA RAO.

1. Schirmer, F. B., *et al.* *J.A.C.S.*, **1942, 64,** 2543. 2. Braun, A. D., *Z. Anal. Chem.*, **1863, 2,** 36. 3. —, *Ibid.*, **1867, 6,** 86. 4. James, R. G. and Wardlaw, W., *J.C.S.*, **1928, 16,** 2726. 5. Dick, A. T. and Bingley, J. B., *Nature*, **1946, 158,** 516-17. 6. Babko, A. K., *J. Gen. Chem. (U.S.S.R.)*, **1947, 17,** 642-48.

NEED FOR GEOPHYSICAL RESEARCH IN INDIA*

ANY number of instances may be given to prove that rich natural resources are not in themselves a guarantee for a nation's prosperity. California a century ago was a decadent Spanish colony of extremely poor and superstitious famine-stricken farmers. Under American flag, its rich resources in gold, oil and water have been harnessed to make it the most prosperous State of the American Union. Kuaitt was an arid desert a decade ago; but with the discovery there of the richest oilfield in the world, large cities have sprung up overnight as it were with all modern amenities including a water supply system based on the distillation of 2 million gallons of sea-water per day. Modern Geophysics gives to the initiated a vision of underground structures even to depths of 5,000 ft. It has given a clue to the discovery of oil, lignite, gold, nickel, chromite ores in the snow-capped regions of the Arctic, placer gold and borax in the western deserts of the United States, underground water in the table land of South Africa. The Standard Oil Company is now carrying out a geophysical survey of the rocks underlying the Bengal alluvium by airborne magnetometer; and the results appear promising enough for this company to start delicate negotiations with the Government of India regarding terms and conditions for exploration of oil in that region.

It is time that a Geophysical Research Institute on an adequate scale is established in India to follow up this adventure of the American Oil Company. The greatest resource of a nation is its storehouse of scientific knowledge and technical skill, because without it, the storehouse of raw materials which might be in the country as a gift from Nature remains buried or unused and is not harnessed for better living. A Geophysical Research Institute may well be the principal key for unlocking and developing for human betterment, the buried resources of India.

* Summary of an address by Dr. J. C. Ghosh, to the Annual Meeting of the Geological, Mining and Metallurgical Society of India on the 3rd Septmber, 1952.

REVIEWS

Ultrasonic Physics. By E. G. Richardson. (Elsevier Publishing Coy., London), 1952. Pp. x + 285.

Ultrasonics, in recent years, has placed in the hands of the experimental physicist a powerful tool for investigating the properties of solids and fluids. Some of them may very well come under the purview of molecular physics. The advent of many new instruments and methods for a precise measurement of the propagation constants has been responsible, to a large extent, for the progress made in the experimental work in fluids. Several books have been published on ultrasonics where the stress is laid more on the technical applications but there are not many in the field which lay stress on the physical aspects.

This need has been met with by the present book under review. The author himself has been a researcher in this field for the past two decades and has given a coherent account of the various methods of investigation employed by him and his school as well as by other workers. A considerable number of pages has been devoted to a description of the construction and use of ultrasonic interferometers as precision instruments. The results obtained by the different investigators are presented extensively and are invariably followed by a critical discussion from the theoretical standpoint.

There are eight chapters. It appears to the reviewer that the book will be of great help to people who wish to start original work in this field as several experimental details are given by an author who has known them well and himself developed some of them. The references given at the end of each chapter are fairly exhaustive.

S. B.

Directory of Indian Mines and Metals. Compiled by P. K. Ghosh. (Published by the Mining, Geological and Metallurgical Institute of India), 1952. Pp. 208. Price Rs. 15.

The Mining, Geological and Metallurgical Institute has done a great service in sponsoring the publication of this valuable Directory and it is specially so because of the absence of any authoritative reference work of this description in the country. Mr. Ghosh, the compiler, has done a splendid job and has gone to the most authoritative sources of available information in providing statistics of production, price levels, ownership of mines, acceptable specifications of mine products, etc. A special feature of the publication is that it not only provides statistical data, but gives good information on the uses of the industrial products, and the commonly used mining equipment and ore-treatment plants. The mining and mineral industries will find the volume useful in their development plans.

The provision of a Mineral Map of India, based on the publications of the Geological Survey of India, adds to the value of the book.

B. P.

Tungsten—A Treatise on Its Metallurgy, Properties and Applications. By Colin J. Smithells. (Published by Chapman & Hall), 1952. Pp. 326. Price 75 *sh.*

The last edition of the book appeared fifteen years ago and since then many developments have taken place in the technology of this strategic metal and its industrial applications. The author and the publisher have rendered a valuable service in bringing out the third edition. In this work, many noted experts have collaborated with Dr. Smithells who assumes the role of an editor, and the result is an authoritative presentation of the available information.

The book has thirteen chapters. The introductory chapter gives the history, geology and mining of tungsten ores and minerals together with statistical data. The next three chapters deal with the extractive metallurgy of tungsten. Chapter 5 is devoted to the production of ductile tungsten and provides details of the powder metallurgy techniques adopted for its manufacture. Information is available on wire-drawing, wire testing and joining tungsten by welding and brazing. Chapter 6 is concerned with the metallography of tungsten including electron microscopy. The production of single crystal wires is discussed. The next three chapters relate to the study of the effect of cold work and annealing on physical properties of the metal, the dependance of physical and mechanical properties on temperature, and the thermionic characteristics of tungsten. The effects of pressure, temperature, particle size and other variables on recrystallisation and

grain growth are well reviewed. The next three chapters cover the alloy systems, manufacturing methods and industrial applications of tungsten, tungsten-iron, non-ferrous alloys and tungsten carbides. The last chapter summarises the methods of assay of the metal and gives the accepted specifications.

The book is amply illustrated with photographs, tables and graphs, and will be found valuable by the specialist and the student alike.

B. P.

Pulp and Paper—Chemistry and Chemical Technology. By James P. Casey. (Inter-Science Publishers, Inc. New York), 1952. Vol. I. *Pulping and Paper-making.* Cloth bound, 6 × 9. Pp. xxiii + 795. Price $ 15. Vol. II. *Properties of Paper and Converting.* Cloth bound, 6 × 9. Pp. xvii + 609. Price $ 15.

This comprehensive and excellent book is written in two volumes. Volume I is devoted to pulping and paper-making and Volume II deals with properties of paper and converting. For the successful manufacture of any product with required properties it is essential to have a thorough knowledge of the chemical and physical properties of all the substances used and of the fundamental principles underlying the various processes employed in its manufacture. This book serves these purposes very admirably so far as the subjects of pulping, paper-making and converting are concerned. The claim of the author that the book "approaches the study of the paper-making raw materials and processes from the standpoint of the colloid and physical chemist" is fully justified. The material has been presented in fundamental terms but care has been taken to see that the gap between strict theory on the one hand and extreme empiricism on the other is properly bridged.

Volume I is divided into fifteen sections. Commencing with a detailed examination of cellulose and hemicellulose, lignin and pulpwood, a very comprehensive treatment is presented of pulping—sulphite, alkaline, mechanical, chemigroundwood, semi-chemical and miscellaneous processes. Subsequent sections deal with the subjects of bleaching, fibre preparation, nature of fibre bonding, sheet formation, filling and loading, and internal and surface sizing. The final sections are devoted to wet strength, colouring, microbiology, and the properties and treatment of water.

Volume II has eight sections and deals with properties of paper, physical, optical, chemical and electrical, uses of statistics in the paper industry, pigment coating, printing, laminating and pasting, internal treatment and coating of paper with resinous materials, and resins, natural and synthetic.

Each volume has excellent author and subject indices. The copious and up-to-date references to original sources considerably enhance the value of the book. The numbering of sections and pages in Volume II is a continuation of that in Volume I.

Much progress in pulping, paper-making and converting has taken place in recent years and the author has spared no pains to describe fully even the latest developments in this field. The book is not a mere collection of facts and figures but presents a balanced and critical account of all the aspects of the subject. The treament is lucid and impressive. Both the volumes are eminently readable and are useful not only to students and mill chemists and technologists but also to research workers.

On page 246, Volume I, bamboo is referred to in Latin as *Dendrocalamus arundinacea*. Evidently, Bambuseæ is meant. In any case, there is no bamboo known as *Dendrocalamus arundinacea*. Apart from this the book is singularly free from lapses.

R. V. Bhat.

Mechanical Properties of Metals at Low Temperatures. (*National Bureau of Standards Circular* 520), 1952. Pp. 206. Price $ 1.50.

The book represents a collection of 9 different papers dealing with almost all European and American investigations, with the relations between alloying elements, structure and grain size on one side and the transition temperature on the other. Special attention has been given to certain steels, non-ferrous and light metals important as structural materials at low and very low temperatures as Cr-Cu-Ni- and austenitic stainless steels. But it is well emphasised that not only the initial metallographic state of a steel determines its behaviour at low temperature but also its more or less resistance to become martensitic on cold-working.

A special chapter is devoted to the tensile properties of copper, nickel and some of their alloys, while two other papers deal with the application of metals in aircrafts and ships at lower temperatures and their tendency to brittleness after welding.

A very important chapter describes the effects of dimensional changes of test specimens of fracture. But in this respect it is regrettable

that the Schnadt notched-bar impact test has not been referred to.

The book represents the first almost complete description of our knowledge about the mechanical properties of metals at low temperatures. The different papers will not only initiate the metallurgist into further investigations, but they will also be highly useful to engineers. Good illustrations and graphs add to the value of the book. Therefore, it can be highly recommended to all those who work in the field of development of metals and alloys, of design, manufacture and application of apparatus, machines and engines for low temperature service.

HANS MAEDER.

Inventories of Apparatus and Materials for Teaching Science, Vol. II, *Universities,* Volume III. *Technical Colleges.* (Published by UNESCO, Paris,) 1951.

These publications form part of the new series of inventories of apparatus and materials for teaching science brought out by the UNESCO. The series is designed particularly to aid educationalists in war-damaged and under-developed regions. The publications are reference manuals from which essential equipment necessary to teach science at all levels may be selected. The lists are based upon the material in common use in the more highly developed and industrialized countries.

Details are given of a model curriculum to which the equipment is related. Teachers are, therefore, given guidance about the kind of course they could undertake, and also what equipment is needed for demonstration and experimental purposes. Professors in our Universities would find extremely useful data in these volumes which could be used for reorganizing the various courses of study.

The 'Inventories' are published in three volumes. Volume II deals with science teaching in Universities. Volume III which has just appeared, is concerned with technical colleges and this third part is devoted to agricultural sciences.

A brief account of the organization of a certain number of schools for the teaching of agricultural sciences chosen from different countries is followed by lists of apparatus, instruments and other equipment necessary for such schools. To illustrate the lists, a syllabus of courses for which such equipment is necessary is given as an example for each of them.

Colour in Theory and Practice. Edited by H. D. Murray. (Chapman & Hall, London), 1952. Pp. 360. Price 70 *sh.* net.

The second edition of this book, rewritten by a panel of eight experts, makes simple and pleasant reading. The first eight chapters are concerned with many essential and some non-essential topics on light and its interaction with matter. The next seven chapters describe visual physiology, elucidate the three attributes of colour sensation and develop three-colour algebra in an informal manner. The C.I.E., Vector, Munsell and Ostwald systems receive due consideration. The chapter on colour discrimination is a useful one, comparing as it does the several proposed U.C.S. transformations and their efficacy. There is a scholarly, but of necessity inconclusive "explanation" of colour vision and a short but adequate chapter on colour-blindness. In the next five chapters on light sources and colorimetry, the account of light sources is probably too detailed. On the other hand, spectrophotometric theory is briefly dismissed. There is an account of many spectrophotometers, but this does not include the universally popular Beckman instrument. Visual colorimeters are treated with justice and there is a good general discussion on photoelectric instruments. The last section of the book, on miscellaneous topics, makes very interesting reading. But it could have been enriched by a discussion of some more topics of importance, for instance, gloss, lustre, and the theory of colorant layers. The absence of a historical account of colour physics is to be deplored. It is also felt that a short chapter on photometry would have been useful. The appendices contain much useful material and the bibliographies are more than adequate. The get-up and illustrations are excellent. Despite the steep price, the book may be warmly recommended to those who are interested in the scope and uses of the subject rather than its mathematical formalism.

T. RADHAKRISHNAN.

Mitchourine, Lyssenko et lé probleme de l'hérédité. par. Jacob Segal. Les Editeurs Francais Réunis, 33, Rue Saint-Andre-des Arts Paris (6').

Like Luther Burbank, Michurin appears to have been a horticultural wizard. But unlike Burbank, Michurin's methods of approach have received the official blessing of those in power in the U.S.S.R. A new science, the so-called "Michurinism", has been brought into being.

A scientist, it is often stated, is rarely honoured in his own country. But Michurin won this distinction. The U.S.S.R. appears to have gone further having compelled acceptance of "Michurinism" by official insistence at the dictation of the party hierarchy. It is this which has been criticized by leading biologists in the democracies.

The book under review is admittedly a defence of Michurinism (p. 8) and as such has all the usual failings. The much publicized conference on "The Situation in the Biological Sciences" held in 1948 is claimed as a revelation which ended in the brilliant victory of Michurinian science (p. 8). This appears to be only one side of the picture. Muller (*Bull. Atom. Sci.*, 1948) offers the following comment: "Finally Lysenko made his historic announcement that the Communist Central Committee had in fact prejudged the case, and had already decided in his own favour. This decision by a non-scientific body, of course, decided the issue". Controversies are not unknown in science. But the so-called victory of Michurinian science led to the discharge with disgrace of the leading students of heredity and evolution of Mendelian inspiration. These facts, of course, find no place in the book under review.

One is surprised to read of Michurin's belief that science could be constructed on the basis of the theories of Marx, Engels, Lenin and Stalin and that the philosophy of dialectic materialism is an instrument for the transformation of the objective world (p. 13). No wonder this method of approach has not appealed to scientists outside the U.S.S.R. who have ignored the papers of the Soviet school (p. 11).

The book is interesting to read and would give the orthodox geneticists an idea of the objections of the supporters of Michurinism.

M. K. S.

Protomorphology—The Principles of Cell Auto-Regulation. By Royal Lee and W. A. Hanson. (Lee Foundation for Nutritional Research, Milwaukee, Wisconsin), 1947. Price $ 8.50.

The Lee Foundation have been waging a war against ignorance in nutritional matters and have never missed a chance of criticising the distributors of substitutes for minor but essential components, such as vitamins. They have extended their activity to include every phase of life, covering factors that maintain normal health and also those that produce disease. In doing so they have been inspired by the work of the late Prof. T. B. Robertson. His theory of allelocatalyst assumes that "the reproducing cells secrete a substance into the media which exerts a powerful influence on cells inhabiting the tissue and the body as a whole." Facts seen from this point of view are presented in the book under review and they are most conspicuous in the appendix on cyto-toxins by Prof. Victrow of Russia who attributes tissue specificity to them. Exploiting such specificity cyto-toxins can be used to attack such wide problems as increasing the egg-laying capacity of hens and reducing sugar in diabetes. The book is well printed, well written and shows that the authors had the courage of their conviction. Where facts are presented in the classical manner the reader will learn much and where they are offered from the new standpoint they would set him thinking. It is here that the book seems quite unique.

S. M.

Electricity Meters and Instrument Transformers. By S. James. (Chapman & Hall, London), First Published 1952. Pp. 467. Price 50 *sh.*

There are a number of books on electricity meters and instrument transformers written by engineers in the electricity supply industry and teachers in engineering. The book under review is by an engineer who has been closely associated with the manufacture of electricity meters and instrument transformers. The author has also been associated in the task of drafting and standardising the British Standard Specification for electricity meters and instruments transformers. The book thus fills a need in giving a complete picture as to the construction and performance and practical working of these instruments both from the users' and manufacturers' points of view. Many matters dealt with in great detail will be of assistance to the student and the young engineer.

In the first chapter the author deals with the specifications and legal requirements relating to electricity meters. A chapter is devoted to different types of D.C. meters. Single-phase meters and the influence of transformer errors are dealt with in detail in two chapters. Two-phase metering, though not in common practice, has also been included along with poly-phase metering.

Commencing with the historical pre-payment meters a large number of types of pre-payment meters has been described in two chapters. These include the single-rate, step-rate and two-part tariff pre-payment meters.

In the fixation of tariffs as applied to large power consumers, a detailed knowledge and understanding of the theory and operation of reactive meters, kVA meters and maximum demand meters, are essential. One chapter each has been devoted to these instruments. For reactive meters the problem of idle currents and of interconnectors have been dealt with. In dealing with kVA meters, meters for ranges of power factor from 0·0 to 1·0 as also meters with spherical integrators have been discussed. Ambiguities in the measurement of kVA have also been treated.

With the advent of the grid system of operation of interconnected power stations, the measurement of bulk supplies to large power consumers has become an important aspect of power metering, and summation meters are being increasingly used for the purpose. A whole chapter has been devoted to the discussion of different types of summation meters.

Current and voltage transformers are essential in the metering of large power consumers and bulk supplies. An understanding of the characteristics and use of these is essential in metering practice. A chapter each has been devoted to the consideration of these.

An useful appendix gives a summary of the revision proposed to the British Standards Specification for electricity meters and instrument transformers.

All the instruments discussed are of British manufacture. It would have been more informative if more information were included of the practice in the manufacture of these in the continent and in the United States of America. A bibliography of references to trade or other literature would have been helpful to students and other workers in the field.

The book serves a very useful purpose of getting the view-point of engineers on the manufacturing side of meters and instrument transformers. The publication of a companion volume devoted entirely to the testing of electricity meters and instrument transformers will be welcome.

C. S. G.

Books Received

Corrosion Testing Procedures. By F. A. Champion. (Chapman & Hall), 1952. Pp. xi + 369. Price Rs. 36.

Advances in Catalysis, Vol. III. Edited by W. G. Frankenburg, I. Komarewsky and E. K. Rideal. (Academy Press Inc.), 1952. Pp. xi + 360. Price $ 7.80.

Selected Topics from Organic Chemistry. By D. D. Karve and G. D. Advani. (Dastane Bros., Poona 2), 1951. Pp. vi + 507. Price Rs. 12.

The Sources and Nature of the Statistics of the United Kingdom, Vol. I. (Macmillan & Co.), 1952. Pp. viii + 352. Price 21 *sh.*

Vermiculite (Colonial Geological Surveys Mineral Resources). By E. R. Varley. (H. M. Stationery Office, London), 1952. Pp. iv + 70. Price 7 *sh.* 6 *d.*

International Review of Cytology, Vol. I. Edited by G. H. Bourne and J. F. Danielli. (Academic Press Inc., New York), 1952. Pp. 368. Price $ 7.80.

Molybdenum Compounds, Their Chemistry and Technology. By D. H. Killeffer and Arthur Linz. (Interscience Publishers), 1952. Pp. xiv + 407. Price $ 10.50.

Maize in the Great Herbals. By John J. Finan. (Chronica Botanica), 1950. Pp. xiv + 149-191. Price $ 3.00.

Should Fatherhood Begin at Forty? By E. Orson Brower. (426, East Girard Avenue, Philadelphia), 1952. Pp. xvi + 240. Price not known.

The Auger Effect. By E. H. S. Burlop. (Cambridge University Press), 1952. Pp. xiv + 188. Price 27 *sh.* 6 *d.*

Kwashiorkor in Africa. By J. F. Brock & M. Autret. (World Health Organisation, Geneva), 1952. Pp. 78. Price $ 1.0.

Agriculture and Animal Husbandry Research, 1929-46, Part II. (*I.C.A.R.,* New Delhi), 1952. Pp. 190. Price As. 8.

Madhmika Rasayana Sastra (*Hindi*). By M. B. Pandy. (Gandhi Bagh, Nagpur), 1952. Pp. 329. Price Rs. 3-4-0.

Madhmika Bhautika Sastra, Part I. By M. B. Pandy. (Gandhi Bagh, Nagpur), 1952. Pp. 96. Price Re. 1.

Corrosion Resistance of Tin and Tin Alloys. By S. C. Britton. (Tin Research Institute), 1952. Pp. 77. Price 3 *sh.* 6 *d.*

Man in Evolution. By M. R. Sahni. (Orient Longmanns, Madras 2), 1952. Pp. x + 272. Price Rs. 8-12-0.

The Physical Principles of Thermodynamics. By R. A. Smith. (Chapman & Hall), 1952. Pp. xiii + 280. Price 30 *sh.*

Colour in Theory and Practice. Edited by H. D. Murray. (Chapman & Hall), 1952. Pp. xiii + 360. Price 70 *sh.*

Polarography, Vol. I, 2nd Edition. By I. M. Kolthoff and James J. Lingane. (Interscience Publishers), 1952. Pp. xvii + 420. Price $ 9.00.

SCIENCE NOTES AND NEWS

New Biological Standards

An important feature of the Fifth Report of the WHO Expert Committee on Biological Standardisation is the complete and up-to-date list of all current international standards in the form of an Appendix. The publication is priced at 15 cents a copy and is also available in a French edition.

Dr. S. Krishna

Dr. S. Krishna, till recently Scientific Adviser to the High Commissioner for India and Scientific Liaison Officer in U.K., has been appointed Deputy Director, Council of Scientific and Industrial Research, New Delhi.

Geological, Mining and Metallurgical Society of India

Council for 1952-53.—President: Mr. M. K. Ray. *Vice-Presidents*: Dr. G. P. Contractor, Mr. A. B. Guha. *Joint Secretaries*: Prof. N. N. Chatterjee, Prof. N. L. Sharma.

Royal Institute of Chemistry: Bangalore Section

At the Third Annual Meeting of the Bangalore Section, the following officers were elected for 1952-53:

Chairman: Prof. K. V. Giri. *Vice-Chairmen*: Prof. K. R. Krishnaswami and Dr. C. V. Natarajan. *Hony. Treasurer*: Mr. I. S. Patel. *Hony. Secretary*: Dr. T. L. Rama Char.

Rajasthan Academy of Sciences

Office-bearers for 1952-53.—*President*: Dr. G. S. Mahajani. *Vice-Presidents*: Dr. N. N. Godbole, Dr. A. Mookherji, Shri. M. L. Schroff, Dr. M. L. Roonwal. *Secretary*: Prof. K. Ramamurti. *Treasurer*: Prof. Roshan Singh.

Electron Microscope in Metallurgy

A Philips 100 KV Electron Microscope has been installed at the Indian Institute of Science, Bangalore. The equipment will be used for metallurgical research and to teach students the latest control methods in metallurgy. Sri. D. L. Bhattacharya is in charge of the Electron Microscope.

Formation of Indian Society of Agronomy

Scientific workers interested in the formation of an Indian Society of Agronomy are requested to contact Prof. R. K. Misra, Principal, M.B. College of Agriculture, Gwalior, who is sponsoring it. The move has our heartiest good wishes.

Award of Research Degree

The University of Poona has conferred the Degree of Doctor of Philosophy in Biochemistry on Mr. T. J. Boman for his thesis on "The Vitamin Requirements and Identification of Lactic Acid Bacteria from Indian Curds and the Study of Their Uses for Microbiological Assays".

The University of Poona has awarded the Degree of Doctor of Philosophy in Plant Pathology to Sri. Y. S. Kulkarni for his thesis on "Some Reports on Bacterial Diseases of Plants."

Glass Laminate Planes to Fly at 2,000 m.p.h.

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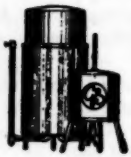

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